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भारत सरकार
Government of India
जल शक्ति मंत्रालय,
Ministry of Jal Shakti,
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग,
Department of Water Resources,
River Development and
Ganga Rejuvenation

केंद्रीय भूमि जल बोर्ड
**Central Ground Water Board**

# NAQUIM 2.0

## जलभृत प्रबंधन योजना
## Aquifer Management Plan
## जत, जिला सांगली, महाराष्ट्र
## Jath, Sangli District, Maharashtra

Central Region, Nagpur
2024

भारत सरकार

**Government of India**

जल शक्ति मंत्रालय

**Ministry of Jal Shakti**

जल संसाधन नदी विकास और गंगा संरक्षण विभाग

**Department of Water Resources, River Development and Ganga Rejuvenation**

केंद्रीय भूमि जल बोर्ड

**Central Ground Water Board**

# जलभृत प्रबंधन योजना

# Aquifer Management Plan

# जत, जिला सांगली, महाराष्ट्र

# Jath, Sangli District, Maharashtra

प्राथमिकता प्रकार: जल संकटग्रस्त क्षेत्र

**Priority Type: Water Stressed Area**

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**Central Region, Nagpur**

**2024**

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## आभार

मैं श्री सुनील कुमार अंबस्त, अध्यक्ष, CGWB एवं श्रीमति टी. एस. अनिथा श्याम, सदस्य (दक्षिण) का हार्दिक आभार और कृतज्ञता व्यक्त करना चाहता हूँ, जिन्होंने मुझे यह रिपोर्ट तैयार करने और लिखने का अवसर दिया।

मैं श्री एन. वरदराज़, क्षेत्रीय निदेशक, CGWB, सी आर, नागपुर के प्रति भी अपनी गहरी कृतज्ञता और ऋणी भावना व्यक्त करता हूँ, जिन्होंने मुझे इस परियोजना का कार्यभार सौंपा। उनके उपयोगी सुझाव और तकनीकी मार्गदर्शन इस रिपोर्ट को लिखने में बहुत सहायक रहे।

मैं श्री कल्याण जाटव, कार्यपालक अभियंता और ड्रिलिंग रिग दल के सभी सदस्यों का भी धन्यवाद करता हूँ, जिन्होंने भूजल अन्वेषण परियोजनाओं को सफलतापूर्वक संपन्न किया।

मैं डॉ देवशरण वर्मा, वैज्ञानिक-ग, डॉ. सैली भांगे, वरिष्ठ तकनीकी सहायक, और उनकी टीम का आभारी हूँ जिन्होंने समय पर जल नमूनों का विश्लेषण किया. श्री जी. एम. लोंढे, भूभौतिकीय डेटा का संग्रह और व्याख्या करने के लिए धन्यवाद देता हूँ जिन्होंने सभी आवश्यक डेटा प्रदान किया।

मैं राज्य सरकार के सभी सम्बद्ध विभागों जैसे ग्रामीण विकास एवं पंचायती राज्य विभाग, भूजल सर्वेक्षण व विकास एजेंसी, जल संपदा विभाग, आर्थिक एवं सांख्यिकी निदेशालय आदि के प्रति आभार व्यक्त करता हूँ जिन्हों ने ससमय आवश्यक आकड़े उपलब्ध कराए.

केंद्रीय भूमि जल बोर्ड, मध्य क्षेत्र, नागपुर के तकनीकी अनुभाग, डेटा केंद्र, रासायनिक अनुभाग, रिपोर्ट प्रोसेसिंग अनुभाग, और पुस्तकालय प्रभाग के प्रति भी मैं आभारी हूँ जिनके द्वारा विभिन्न आवश्यक डेटा प्रदान किये बिना जिसके यह रिपोर्ट पूरी नहीं हो पाती।

अंत में मैं उन सभी व्यक्तियों का धन्यवाद करता हूँ जिन्होंने इस प्रयास में अपना सहयोग दिया।

डॉ. पंडित मधुनुरे

वैज्ञानिक- घ

केंद्रीय भूमि जल बोर्ड

**मध्य क्षेत्र, नागपूर**

August-2024

**प्रस्तावना**

महाराष्ट्र राज्य के सांगली जिला के जथ ब्लॉक में सूक्ष्म स्तर पर जलभृतों की पहचान और मानचित्रण करने, भूजल संसाधन की उपलब्धता की मात्रा निर्धारित करने और क्षेत्र में बुनियादी भूजल संबंधी मुद्दों के समाधान के लिए जलभृत प्रबंधन योजनाओं का सुझाव देने के उद्देश्य से जलभृत मानचित्रण अध्ययन किया गया है। एक्विफर मैपिंग अध्ययन में भूवैज्ञानिक, हाइड्रोजियोलॉजिकल, जियोफिजिकल, हाइड्रोलॉजिकल और हाइड्रो-केमिकल सहित बहु-विषयक वैज्ञानिक पहलुओं का एकीकरण और विश्लेषण शामिल है। ये अध्ययन जलभृतों में मात्रा, गुणवत्ता और भूजल संचलन को चिह्नित करने और उनके इष्टतम प्रबंधन योजनाओं को तैयार करने में मदद करते हैं। अध्ययन का प्रतिनिधि क्षेत्र महाराष्ट्र राज्य में है और सुपरग्रुप का हिस्सा है।

"महाराष्ट्र के सांगली जिला के जत ब्लॉक की जलभृत मानचित्रण और प्रबंधन योजना" पर रिपोर्ट में जलभृत मानचित्रण अध्ययन के परिणाम, विशेष रूप से जलभृत इकाइयों की ऊर्ध्वाधर और पार्श्व सीमा, उनकी विशेषताओं और विभिन्न तनाव स्थितियों के लिए जलभृत इकाइयों की प्रतिक्रिया और उचित प्रबंधन योजनाओं के माध्यम से उनका निवारण। क्षेत्र में स्थायी भूजल विकास और प्रबंधन के लिए तकनीकी और वैज्ञानिक उपायों को एकीकृत करके विभिन्न जल संरक्षण के विकल्पों की भी सिफारिश की गई है।

इस रिपोर्ट को लाने में डॉ. पंडित माधनुरे, वैज्ञानिक-घ द्वारा किए गए प्रयास की विधिवत सराहना की जाती है। रिपोर्ट योजनाकारों और प्रबंधकों के साथ-साथ शिक्षाविदों / शोधकर्ताओं के लिए भूजल संसाधन प्रबंधन के क्षेत्र में एक गाइड और संदर्भ के रूप में अत्यधिक उपयोगी होगी।

एन. वरदराज
16/8/24

स्थान: नागपुर

तारीख:

(एन वरदराज़)क्षेत्रीय निदेशक

डॉ. सुनील कुमार अम्बष्ट
अध्यक्ष
Dr. Sunil Kumar Ambast
Chairman

भारत सरकार
जल शक्ति मंत्रालय
जल संसाधन,
नदी विकास और गंगा संरक्षण विभाग
केन्द्रीय भूमि जल बोर्ड
Government of India
Ministry of Jal Shakti
Department of Water Resources,
River Development & Ganga Rejuvention
Central Ground Water Board

**Message**

National Aquifer Mapping and Management Programme (NAQUIM) was initiated by Central Ground Water Board (CGWB) in 2012 with the goal of mapping and managing aquifers across India to promote sustainable groundwater use. So far the entire mappable area of 25 lakh km$^2$ has been covered under the NAQUIM programme. While these initial efforts have been highly impactful, they faced certain limitations especially in terms of spatial resolution.

Taking it forward, CGWB has now initiated **NAQUIM 2.0,** the next phase of aquifer mapping designed to provide a deeper, more detailed understanding of India's groundwater systems. During 2023-24, CGWB had completed NAQUIM 2.0 studies in 68 study areas. The study areas were selected in consultation with the State/UT government agencies.

I am confident that this report of NAQUIM 2.0 study will serve as a critical resource for government agencies, research institutions, NGOs, and the general public. By fostering a collaborative approach to groundwater management, this report will play a key role in safeguarding and sustaining India's precious ground water resources.

**(Dr. Sunil Kumar Ambast)**

**Chairman, CGWB**

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Smt. T. S. Anitha Shyam
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## Message

I am glad to present the report on *National Aquifer Mapping and Ground Water Management Plan* for Jath block, Sangli district Maharashtra.

This report suggests a panchayat-level, implementable management plan that addresses groundwater issues of Jath block, Sangli. The plan incorporates a multidisciplinary approach, including geological, geophysical, hydrogeological, hydrological, and water quality analyses, leveraging issue-based high-density dynamic data.

I am hopeful that management plan suggested in this report will help in proper management of ground water resources in the targeted area.

I would like to appreciate the work done by the team of NAQUIM 2.0, Central Ground Water Board, Central Region, Nagpur.

**(Smt. T. S. Anitha Shyam)**

# कार्यकारी सारांश

महाराष्ट्र के सांगली जिले के जल-संकटग्रस्त जत तहसील में वार्षिक-कार्य-योजना 2023-24 की अवधि में 'राष्ट्रीय जलभृत मानचित्रण-2.0' (रा.ज.मा.-2.0) अध्ययन, किया गया और "महाराष्ट्र के सांगली जिले के जत ब्लॉक की जलभृत प्रबंधन योजना" शीर्षक से रिपोर्ट तैयार की गई।

अध्ययन क्षेत्र, 2248 वर्ग किलोमीटर के भौगोलिक क्षेत्र में फैला है जो अक्षांश 16° 50' तथा 17° 19' और देशांतर 74° 59' तथा 75° 41' के बीच स्थित है। इस क्षेत्र की आबादी लगभग 3.28 लाख है और प्रशासनिक रूप से 116 ग्राम पंचायतें इसका संचालन करती हैं। भीमा नदी की एक सहायक नदी बोर नदी इस क्षेत्र के पूर्वी भाग में बहती है और यहाँ का मुख्य जल-निकासी स्वरूप 'डेन्ड्रिटिक' (वृक्ष के समान) से लेकर 'सब-डेन्ड्रिटिक' है। इस क्षेत्र में सामान्य वार्षिक वर्षा 410 मिमी होती है और यहाँ मुख्य रूप से बेसाल्ट चट्टानें हैं और ये चट्टानें टूटी हुई और जोड़दार हैं और कुछ स्थानों पर मध्यम स्तर का अपक्षय दिखाती हैं। यहाँ मौजूद भू-आकृतियाँ कटाव वाली चौड़ी घाटियाँ हैं जो सपाट शीर्ष वाली अवशिष्ट पहाड़ियों को अलग करती हैं और सीढ़ीनुमा परिदृश्य प्रस्तुत करती हैं।

कुल सिंचित क्षेत्र 49894 हेक्टेयर है और इसका अधिकांश हिस्सा पश्चिमी भाग और दक्षिण-पूर्वी भाग में है। वर्ष 2022-23 के दौरान सतही जल से शुद्ध सिंचित क्षेत्र 19515 हेक्टेयर और भूजल से 8291 हेक्टेयर रही। खेती योग्य क्षेत्र 1,73,014 हेक्टेयर (77.05%) है, शुद्ध बोया-गया क्षेत्र 1,64,460 हेक्टेयर (73.24%) और दोहरी फसल वाला क्षेत्र इसके भौगोलिक क्षेत्र का 10.9% है।

भूजल, उथले जलभृतों में अप्रतिबंधित परिस्थिति (30 मीटर की गहराई तक), गहरे जलभृतों में अर्ध-सीमित परिस्थिति (20 से 40 मीटर की गहराई तक) और सीमित परिस्थितियों (100 मीटर की गहराई तक) में पाया गया है। भूजल मुख्यतः 60 से 100 मीटर गहराई के बोरवेलों द्वारा निकाला जाता है। इन बोरवेलों से निर्वहन 0.02 से 5 लीटर/सेकंड (ली.प्र. से.) तक होती है।

अध्ययन के अंतर्गत 120 से 200 मीटर तक की गहराई वाले कुल 13 बोरवेल का निर्माण किया गया। ये बोरवेल गहरे जलभृतों तक बनाए गए हैं, जिससे 4.5 लीटर प्रति सेकंड (ली। प्र. से.) तक का निर्वहन हुआ है। दो स्थानों पर गणना की गई संचारण क्षमता 27 और 50 वर्ग मीटर/दिन है, और भंडारण क्षमता 0.00012 और 0.0002 है। भूजलीय स्थिति जानने के लिए कुल 46 ऊर्ध्वाधर विध्युतीय साउंडिंग (संकेत) की गई। ऊर्ध्वाधर विध्युतीय साउंडिंग द्वारा अनुमानित भूवैज्ञानिक परतें भू-स्तर (भू.से नी. ) से 7 मीटर नीचे तक फैली ऊपरी मिट्टी से बनी होती हैं। इससे अधिक गहरा अपक्षयित बेसाल्ट चट्टानें 1.6 और 42 मीटर भू.से नी. (भू-स्तर से नीचे) के बीच पाई जाती है। यह परत 177 मीटर भू.से नी. की गहराई तक खंडित/केशिकीय बेसाल्ट चट्टानों द्वारा अंतर्निहित है। ये सभी परतें विशाल बेसाल्ट चट्टान के ऊपर हैं।

त्रि-विमीय भूजलीय नमूना और बाड़ आरेख तथा क्षेत्र के ऊर्ध्वाधर-भू-काटों की संकल्पना, 200 मीटर तक खोदे गए अन्वेषन बोरवेलों की व्याख्या और तथा भूभौतिकीय सर्वेक्षणों से प्राप्त आंकड़ों को एकीकृत करके तैयार की गई है। परिणाम से पता चलता है, कि सामान्य तौर पर, ऊपरी अपक्षयित भाग उथले जलभृत का प्रतिनिधित्व करता है। तैयार किए

गए ऊर्ध्वाधर-काटों और मानचित्र इंगित करते हैं कि अपक्षयित क्षेत्र की मोटाई 3 से 6 मीटर की गहराई सीमा के बीच है जो मध्य और पश्चिमी भाग में 55% क्षेत्र को कवर करती है। उल्लेखनीय रूप से, पूर्वी भाग (28% क्षेत्र) में 6 से 9 मीटर की मोटाई देखी गई। 3 मीटर भू. से नी. तक की उथली गहराई को पैच के रूप में देखा गया। अपक्षयित क्षेत्र के नीचे, वातामकी, केशिकीय और खंडित बेसाल्ट चट्टानें गहरे जलभृत का निर्माण करती हैं।

अन्वेषणात्मक भू-वेधन के आकड़ों से पता चलता है कि अधिकांश चट्टानी-दरारें 50 से 100 मीटर की गहराई (34% दरारें) में हैं। लगभग 22% दरारें 30 मीटर की उथली गहराई में हैं और 20% दरारें 150 मीटर की गहराई से नीचे हैं तथा सबसे गहरी चट्टानी-दरारें क्षेत्र के दक्षिण-पश्चिमी भाग में 193-196 मीटर की गहराई पर पाई गई हैं।

कुल 226 खोदे गए कुओं की सूची बनाई गई जो उथले जलभृत ((अपक्षयित क्षेत्र) का प्रतिनिधित्व करते हैं, जिनकी गहराई 4.5 से 30 मीटर के बीच है। इसी प्रकार गहरे जलभृत के लिए, 33-315 मीटर की गहराई-सीमा वाले कुल 229 बोरवेलों की सूची वर्ष 2023 में बनाई गई और जल स्तर द्वारा भूजल की निगरानी और भूजल-गुणवत्ता की जांच की गई।

प्रथम जलभृत (उथले) में, मानसून-पूर्व जल स्तर, 1 से 25.5 मीटर भू.से नी. तक था। 5 से 10 मीटर भू.से नी. का जलस्तर-वर्ग क्षेत्र के 65% हिस्से में पाया गया, जबकि उथले जल स्तर (<5 मीटर बीजीएल) कई छोटे क्षेत्रों में पाया गया। मानसून के बाद की अवधि के दौरान, 0.75 से 10 मीटर भू.से नी. के जल स्तर के बीच पाया गया जिसमें 5 से 10 मीटर भू.से नी. द्वारा आच्छादित क्षेत्र घटकर 61% हो गया, और इसके साथ ही पूर्वी क्षेत्र में उथले जल स्तर (<5 मीटर भू.से नी.) वाला क्षेत्र बढ़ गया। मानसून के बाद, मानसून-पूर्व अवधि की तुलना में 0 से 2 मीटर की सीमा के मध्य जल स्तर में उतार-चढ़ाव क्षेत्र के एक बड़े हिस्से (57%) में देखा गया, जिसमें क्षेत्र के मध्य और उत्तरी भाग शामिल थे।

दूसरे जलभृत (गहरे) में मानसून-पूर्व जल स्तर जमीन से 1.78 से 112.4 मीटर नीचे (भू.से नी.) था। 20 से 40 मीटर भू.से नी. के जल स्तर वर्ग 47% क्षेत्र में पाया गया, जबकि सबसे गहरा जल-स्तर वर्ग >40 मीटर भू.से नी. ने अध्ययन क्षेत्र के 43% हिस्से में फैला। मानसून के बाद की अवधि में जल स्तर 1.5 से 102.5 मीटर के बीच बढ़ा। सबसे गहरे जल स्तर वाले क्षेत्र के क्षेत्रफल में कमी केवल 32% रही। क्षेत्र के पश्चिमी भाग में, 5 से 10 मीटर भू.से नी. का उथला जलस्तर वर्ग देखा गया। अध्ययन-क्षेत्र के अधिकांश भाग में, मानसून संबंधी जल-स्तर में वृद्धि 0 से 6 मीटर की सीमा के भीतर गया।

भूजल संसाधन आकलन का एक प्राथमिक घटक मृदा-अंतःस्यंदन के मान को, दोहरे-वलय वाले अंतःस्यंदनमापी का क्षेत्रीय प्रयोगों के आधार पर परिशुद्ध करने की कोशिश की गई थी। आठ विभिन्न स्थानों पर किए गए मृदा-अंतःस्यंदन परीक्षणों से प्राप्त औसत मान (10.75%), औसत वर्षा गुणांक 11% के विचारित मूल्य के बहुत करीब है, इसलिए इसे और परिशुद्ध करने का सुझाव नहीं दिया गया।

जत तालुका में भूजल की रासायनिक गुणवत्ता का मूल्यांकन करने के लिए, 2023 के मानसून-पूर्व की अवधि (मई) और 2023 के मानसून-पश्चात की अवधि (नवंबर) के दौरान चिन्हित अवलोकन कुओं से कुल 424 और 242 जल-नमूने एकत्र किए गए। इन नमूनों का विश्लेषण प्रमुख धनायनों और प्रमुख ऋणायनों के लिए किया गया। प्रमुख आयन रसायन विज्ञान के आधार पर, पाइपर और यू.स्टे.ल.आ. (यूनाइटेड स्टेट लवणता आरेख)जैसे विभिन्न ग्राफ तैयार किए गए।

विद्युत चालकता (वि.चा.) पानी की गुणवत्ता का एक प्रमुख संकेतक है। सामान्य तौर पर, वर्षा जल और समुद्री जल के लिए इसका मान 25°C पर क्रमशः 10 से 50,000 मिली सीमेन प्रति सेंटीमीटर (मि.सी./सें.मी.) तक होता है। वि.चा. का मान 03 स्थानीय क्षेत्रों में 3000 से अधिक है। ये क्षेत्र पूर्वी भाग, मध्य भाग और जत तालुका के उत्तरी भाग के एक छोटे हिस्से में हैं।

जत तालुका के उत्तरपूर्वी भाग के कुछ छोटे हिस्सों में फ्लोराइड की मात्रा 1.5 मिलीग्राम/लीटर (मि.ग्रा./ली.) की अनुमेय सीमा से अधिक पाई गई है। जत तालुका के उत्तर-पूर्वी भाग के एक छोटे से हिस्से को छोड़कर हर स्थान पर नाइट्रेट का मान, अनुमेय सीमा (>45 मि.ग्रा./ली.) से अधिक पाया गया है। नाइट्रेट अमूमन उर्वरक से निकलकर पानी में घुलता है।

मानसून-पूर्व की अवधि के दौरान कुल 67 भूजल-नमूने एकत्र किए गए और लेशतत्वों का विश्लेषण किया गया। 'जलायल भुद्रुक' गांव में सेलेनियम और पारा की सांद्रता और 'करजगंज' गांव में पारा 'भारतीय मानक ब्यूरो' की अनुमेय सीमा से अधिक पाया गया है।

पीने और सिंचाई के उद्देश्य के लिए भूजल की योग्यता के लिए रासायनिक गुणवत्ता डेटा का विश्लेषण किया गया है। विश्लेषण से पता चलता है कि दोनों मौसमों (मानसून-पूर्व और मानसून-पश्चात) में उथले जलभृतों की तुलना में गहरे जलभृतों में फ्लोराइड की सांद्रता अधिक होती है। यह भी देखा गया है कि मानसून के बाद के मौसम में नाइट्रेट की सांद्रता उथले जलभृतों में 100% और गहरे जलभृतों में 80% तक बढ़ गई। जहां तक सिंचाई के लिए उपयुक्तता पर विचार किया जाता है, अधिकांश नमूने (63% और 66%) उथले जलभृत से और 57% और 59% गहरे जलभृत से क्रमशः पूर्व और मानसून के बाद के मौसम में सी 3-एस 1 प्रकार के पाये गए हैं, जो अमेरिकी लवणता का एक वर्ग है। यह वर्ग उच्च लवणता और कम सोडियम-खतरों को इंगित करता है।

केन्द्रीय भूजल बोर्ड द्वारा इस क्षेत्र में निर्मित अन्वेषण कुओं से प्राप्त भूजल की गुणवत्ता सामान्यतः पीने योग्य है।

प्रकाशित शोध-पत्र , क्षेत्र-भ्रमण और ग्रामीणों से चर्चा के आधार पर यह निष्कर्ष निकाला गया है कि इस क्षेत्र में कोई भूमि-धंसाव नहीं है। भूमि धंसाव का मतलब यह भी हो सकता है कि बड़ी मात्रा में भूजल निकाले जाने के कारण जल स्तर में गिरावट आ गई हो।

अध्ययन से प्रमुख समस्याओं की पहचान, कम वर्षा, मौसम की उथली गहराई, गहरा जल स्तर, दशकों से जल स्तर में गिरावट की प्रवृत्ति, कम उपज क्षमता, गर्मी के महीनों के दौरान पानी की कमी, मौजूदा भूजल-निकासी स्रोतों की विश्वसनीयता, भूजल की गुणवत्ता और जल-विपणन के रूप में की गई है। इन समस्याओं पर काबू पाने के लिए प्रचलित उपायों की अनुशंसा की गई है।

उपलब्ध भूजल संसाधनों के दीर्घकालीन उपयोग व भरोसेमंद बनाने के लिए, चार श्रेणियों के तहत रणनीति की सिफारिश की गई है: आपूर्ति पक्ष, मांग पक्ष, संस्थागत और नियामक उपाय।

आपूर्ति पक्षीय प्रबंधन के अंतर्गत चल रही परियोजनाएँ इस प्रकार हैं: (क) अटल भूजल योजना (अ.भू.यो.): इस कार्यक्रम के अंतर्गत 22 गाँवों में संस्थागत सुदृढ़ीकरण और जन-भागीदारी के उपाय किए गए हैं और इस योजना के अंतर्गत 541 रिचार्ज शाफ्ट, 6 चेक डैम, 2 केटी वियर (कोल्हापुरी-टाइप मेंढ) और 6 अंतःस्रावी तालाब का निर्माण किया गया है। (ख) जलयुक्त-शिवर:- जल युक्त शिवर के अंतर्गत, मृदा और जल संरक्षण विभाग, महाराष्ट्र सरकार ने सीमेंट बंधारों के निर्माण, पारंपरिक जल निकायों के जीर्णोद्धार आदि के माध्यम से जल

संरक्षण और जल संचयन जैसे विभिन्न प्रकार के कार्य किए हैं। (ग) जल जीवन मिशन (ज. जी. मि.): के अंतर्गत, जत ब्लॉक के अधिकांश गाँवों को भूजल स्रोत से पाइप द्वारा जलापूर्ति की जा रही है। भूजल स्रोतों को सूखने से बचाने के लिए उपयुक्त पुनर्भरण योजना के अलावा जलीय-भंग या क्षैतिज बोरवेल ड्रिलिंग की सिफारिश की जाती है। उपरोक्त के अलावा, आपूर्ति पक्ष प्रबंधन के तहत की जाने वाली प्रबंधन योजना इस प्रकार है:

(क) मौजूदा संरचनाओं की मरम्मत, नवीनीकरण और जीर्णोद्धार (म.न.जी.): 02 मध्यम सिंचाई परियोजनाएं, 27 लघु राज्य स्तरीय और 05 लघु स्थानीय स्तर की सिंचाई परियोजनाएं, 41 कोल्हापुरी प्रकार के बंधारा, 188 रिसाव टैंक और 173 भंडारण टैंक 'म.न.जी.' के लिए पहचाने गए हैं।

(ख) कृत्रिम पुनर्भरण संरचनाओं का निर्माण: अध्ययन के आधार पर, 125 गांवों में से 110 गांवों में 426 कृत्रिम पुनर्भरण संरचनाओं (पु. सं) (चेक डैम: 213 और पुनर्भरण शाफ्ट: 213) के निर्माण का सुझाव दिया गया है।

(ग) जल संरक्षण उपाय: उपरोक्त कृत्रिम पुनर्भरण हेतु अनुपयुक्त गांवों के उपयुक्त स्थानों पर खेत-में-तालाब और समोच्च खाइयां बनाए जाने का सुझाव है।

मांग पक्षीय प्रबंधन के तहत, पारंपरिक बाढ़ सिंचाई विधियों के बजाय टपक तथा छिड़काव सिंचाई और अंतरफसल का सुझाव दिया गया है।

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# Executive Summary

The NAQUIM-2.0 studies were taken up during the AAP 2023-24 in water stressed Jath block of Sangali District, Maharashtra and the report entitled **"Aquifer Management Plan of Jath Block, Sangali District, Maharashtra"** is prepared.

The study area, covering a geographical area of 2248 $Km^2$ lies between NL 16° 50' and 17° 19' and EL 74° 59' and 75° 41'. The area having a population of ~3.28 lakhs and administratively governed by 116 gram panchayats. The Bor river, a tributary of Bhima River flows in eastern part of area and the major drainage pattern dendriti to sub-dendritic. The area receives normal annual rainfall of 410 mm and predominantly underlain by basalt rocks and these rocks are fractured and jointed and show moderate degree of weathering at places. The land forms present are erosional broad valley separating flat topped remnant hills, displaying characteristic step like appearance.

The total command area is 49894 ha and mostly lies in western part and in south-eastern part. The net irrigated area during 2022-23 from surface water is 19515 ha and from ground water it is 8291 ha. The cultivable area is 1,73,014 ha (77.05%), net area sown is 1,64,460 ha (73.24%) and the double cropped area is 10.9% of its geographical area.

Ground water occurs under unconfined conditions (up to 30-meter depth) in shallow aquifers and in semi-confined (20 to 40-meter depth) and confined conditions (up to 100-meter depth) in deeper aquifers. Ground water is mainly extracted by bore wells of 60 to 100 m depth. The yield from these bore wells varies from 0.02 to 5 litres/second (lps).

Total of 13 borewells were constructed down to depth range of 120 to 200 meters. These borewells tap into deeper aquifers, revealing discharges of up to 4.5 liters per second (lps). Transmissivity values calculated at two locations are 27 and 50 $m^2$/day, and Storativity of 0.00012 and 0.0002. Total 46 Vertical Electrical Sounding (VES), were conducted to know sub surface aquifer disposition. The VES-inferred geological layers consist of topsoil extending down to 7 m below ground level (bgl). Deeper than this, weathered basalt occurs between 1.6 and 42 m bgl. This layer is underlain by fractured/vesicular basalt down to a depth of 177 m bgl. All these layers overlie massive basalt.

Conceptualization of 3-D hydrogeological model, fence diagrams and sections of the area are prepared by interpreting and integrating representative exploratory borewells drilled down to 200 m and from interpreted data from geophysical surveys. The results reveal, in general, the overlying weathered zone represents the shallow aquifer. The cross sections and maps prepared indicates the thickness of weathered zone is between 3 and 6 m depth range covering 55% of area in central and western part. Remarkably, the range of 6 to 9 m thickness observed in eastern part (28% area). Shallow depth range down to 3 m bgl observed as patches. Below the weathered zone, amygdaloidal, vesicular and fractured basalt forms the deeper aquifer.

Exploratory drilling data reveals that majority of fractures occur in depth ranges of 50 to 100 m (34% of fractures). ~22% fractures occur within shallow depth of 30 m and 20% fractures occur below 150 m depth and deepest fracture is encountered at depth range of 193-196 m in south-western part of area.

A total of 226 dug wells inventoried which represents shallow aquifer ((weathered zone), whose depth varies between 4.5 to 30 m. Similarly, for the deeper aquifer, total 229 bore wells having depth range of 33-315 m, were inventoried during 2023 and monitored for water levels and ground water quality.

In 1st aquifer, pre-monsoon water level ranged from 1 to 25.5 m bgl. The classified segment of 5 to 10 m bgl covered 65% of the area, while shallow water levels (<5 m bgl) were observed as patches in many areas. During the post-monsoon period, the area covered by water level range of 0.75 to 10 m bgl and the area covered by 5 to 10 m bgl decreased to 61%, and complimentarily the area of shallow water level (<5 m bgl) increased in eastern region. During post-monsoon water level fluctuation with respect to the pre-monsoon period in the range of 0 to 2 m was observed in a major part (57%) of the area, covering the central and northern regions.

In 2nd aquifer (deeper) the pre-monsoon water level ranged between 1.78 and 112.4 meters below ground level (m bgl). The water level range of 20 to 40 m bgl covered 47% of the area, whereas the deepest category of >40 m bgl covered 43% of the study area. During the post-monsoon period, the water level rose by between 1.5 and 102.5 meters. The area with the deepest water levels reduced to only 32%. In the western part of the area, a shallow water level range of 5 to 10 m bgl was observed. In major part of the area, monsoon-related fluctuation was observed within a range of 0 to 6 meters

Soil infiltration, a primary component of groundwater resource estimation, was tried to be refined based on field experiments using a double ring infiltrometer. The average rainfall coefficient from infiltration tests (10.75%) conducted at eight various locations is very close to the considered value of 11%, therefore no further refinement was suggested.

To evaluate chemical quality of the groundwater in Jath Taluka, total 424 samples and 242 samples were collected from established key observation wells during pre-monsoon season (May) of 2023, and post-monsoon season (November) of 2023 respectively. The samples were analysed for major cations and major anions. Based on major ion chemistry, various plots such as Piper and USSL diagram were generated.

Electrical conductivity (EC) is a key indicator of water quality. In general, its value ranges from 10 to 50,000 µs/cm at 25°C for rainwater and seawater, respectively. The EC value is exceeding 3000 in 03 localised area viz eastern part, central part and as a small patch in northern part of Jath taluka.

The fluoride concentration exceeding permissible limit of 1.5 mg/l in localised areas in northeastern part of Jath taluka. The higher value of Nitrate, more than permissible limit (>45 mg/l) has been found at every location except the north eastern part of Jath taluka. It is released from fertiliser.

Total 67 samples were collected during pre-monsoon period and analysed for trace elements. The concentration of Selenium and mercury at Jalayl (Bk) village and mercury in Karajganj village have been found beyond the permissible limit of BIS.

The chemical quality data has been analysed for its suitability for drinking and irrigation purpose. The analysis indicates that during fluoride concentration is more in deeper aquifers as compared to shallow aquifers in both seasons. It is also observed that nitrate concentration increased 101 during post-monsoon season by 100% in shallow aquifer and by 80% in deeper aquifers. As for suitability for irrigation is considered, majority of samples (63 % & 66 %) from shallow aquifer and 57% & 59% from deeper aquifer during pre and post-monsoon season respectively falls C3-S1 type, a class of the US salinity diagram which indicates high salinity and low sodium hazards.

The ground water quality as observed from the exploratory-wells constructed by Central Ground Water Board is generally suitable for drinking purpose.

On the basis of published literature, field travers and discussion with the villagers it has been concluded that there is no land subsidence in the area. The land subsidence may indicate water level drop due to withdrawal of large quantity of ground water.

The major issues from the study are identified as Low rainfall, Shallow depth of weathering, deeper water level, water level declining trend over decade, low yield potential, water scarcity during summer months, source sustainability of existing ground water structures, ground water quality issues and water marketing. The prevailing interventions have been recommended to overcome these issues.

In order to manage the available ground water resources in sustainable manner, the strategy recommended under the four categories: Supply side, Demand side, Institutional and Regulatory measures.

Under the supply side management, the ongoing projects are:

Atal Bhujal Yojna (ABHY): Under this program institutional strengthening and participatory measures are taken up in 22 villages and under this scheme construction of 541 recharge shaft, 6 check dam, 2 KT weirs and 6 percolation tanks are taken up.

Jalyukt-Shivar: Under Jal Yuktha Shivar, Soil and Water Conservation Department, Government of Maharashtra has taken various types of works like water conservation and water harvesting by construction of cement bandharas, renovation of traditional water bodies etc.

Jal Jeevan Mission (JJM): Under JJM, most of the villages from Jath block are covered with piped water supply with ground water as source of water. To strengthen the source, hydrofracturing or horizontal bore well drilling is recommended in addition to the suitable recharge plan.

Besides above, the management plan to be taken up under supply side management are:

Repair, Renovation & Restoration (RRR) of existing structures (Existing): there are 02 medium irrigation projects, 27 small state level and 05 small local level irrigation projects, 41 Kolhapur Type bandharas, 188 percolation tanks and 173 storage tanks are identified for RRR.

Construction of artificial recharge structures: Based on the study, construction of 426 artificial recharge structures (ARS) (Check Dam:213 and Recharge Shafts:213) are suggested in 110 villages out of 125 villages.

Water conservation Measures: The villages, not suitable for artificial recharge, farm pond and contour trenches at suitable locations.

Under the Demand Side management, drip and sprinkler irrigation instead of traditional flooding irrigation methods and intercropping are suggested.

***

REPORT ON

# AQUIFER MAPPING & MANAGEMENT PLAN (NAQUIM 2.0)JATH BLOCK, SANGLI DISTRICT, MAHARAHTRA

## Figures

**Tables:**

REPORT ON

## AQUIFER MAPPING AND MANAGEMENT PLAN (NAQUIM 2.0) JATH BLOCK, SANGLI DISTRICT, MAHARAHTRA

### AT A GLANCE

| S. No. | Item | | Particulars |
|---|---|---|---|
| 1 | Districts | : | Sangli |
| 2 | Block | : | Jath |
| 3 | No of Villages/ GramPanchayats | : | 125/116 |
| 4 | Geographical area | : | 2,248 $Km^2$ |
| 5 | Population (2011 Census) | : | ~3,28,324 |
| 6 | Locations | : | North Latitude 16°50´-17°19´ East Longitude 74°59´-75°41´ covering Toposheets 47 O/3,4,7,8,11,12, 47 K/16,47 L/13 and 47P/1, 47 P/5 & 47 P/9. |
| 7 | Normal/Actual Rainfall | : | 410 mm (average of last 26 years)<br>During 2023 it received 341 mm (17% less) |
| 8 | Geomorphology | : | Pediment -Pedi plain Complex (86%), Highly Dissected Upper Plateau (8%), Moderately Dissected Lower Plateau (3%) etc. |
| 9 | Major Rivers | : | Bor River a tributary of Bhima River |
| 9.1 | Basin | : | 2 Basins (Bhīma -BM, Krishna - KR) |
| 9.2 | Watersheds | : | 12 nos (BM-112, BM-116, BM-117, BM-118, BM-119, BM-120, BM-121, BM-122, BM-123, KR-38, KR-52, KR-53) |
| 10 | Forests | : | ~5.03% (113.05 $Km^2$) |
| 11 | Soils | : | Medium to shallow black soils and red sandy soils. Fairly high in $CaCO_3$. |
| 12 | Land Utilization (Ha) | : | Cultivable area:173014 ha, |

| | | | |
|---|---|---|---|
| 13 | Cropped area (Ha) | : | Net area sown:164460 ha, double cropped area:24413 ha |
| 14 | Irrigation Projects | : | Medium:2 & MI:32, PT:188, KT Weirs:41 and Farm ponds:173, |
| 14.1 | Area under Irrigation | : | SW:5878 ha and GW:2413 ha (Total:8291 ha). |
| 15 | Geology | : | Deccan Traps |
| 16 | Exploratory Drilling (CGWB and GSDA) | : | EW-21, OW-4, Pz-1 (Total:26 nos) |
| 17 | Geophysical Surveys (VES) | : | 55 nos |
| 18 | Number of ground water structures | : | Dug wells (Irr.):21642 (identified from google earth), Dug wells (Domestic):2413, BW:8939 |
| 19 | Ground water yield (lps) | : | 0.02 to 5 mainly extracted between 60-100 m depth. Specific capacity:1.7 to 18.9 lpm/m. Transmissivity:2.6-36 $m^2$/day and Storage co-efficient: $1.2 \times 10^{-4}$ to $6.52 \times 10^{-4}$ |
| 20 | Water Levels (2023) | : | |
| 20.1 | Depth to water Table Elevations (m amsl) | : | Aquifer-1: Pre-monsoon:< 440 to 780<br>Aquifer-2: Pre-monsoon:< 390 to 720 |
| 20.2 | Depth to water levels<br>(m bgl) | : | **Aquifer-1:** 226 nos.<br>Pre-monsoon season: 1.08 to 25.5 (<5 m covers 65% area).<br>Post-monsoon season: 0.75 to 25.5 (<5 m covers 61% area). |
| | | | **Aquifer-2:** 229 nos.<br>Pre-monsoon season: 1.78 to 112.4 (20-40 m bgl covers 47 % area).<br>Post-monsoon season: 1.5 to 102.5 (20-40 m covers 45% area). |
| 20.3 | Long term water level trends m/yr. | : | 25 wells<br>Pre-monsoon: 20 wells: rising @0.03- |

| | | | |
|---|---|---|---|
| | | | 0.91 m/yr and 5 wells: falling @-0.1 to >0.2 m/yr.<br>Post-monsoon: 16 wells: rising @0.0-0.8 m/yr and 9 wells: falling @-0.1 to >0.27 m/yr. |
| 21 | Ground water Resources (2023) | : | |
| 21.1 | Annual Extractable GW Resource | : | 258.7 mcm |
| 21.2 | GW Extraction for all uses | : | 165.14 mcm |
| 21.3 | Allocation of GWR for projected year (2025) | : | 6.92 mcm |
| 21.4 | Stage of Ground water Extraction (%) | : | 63.8 mcm |
| 21.5 | Net GW Availability for future irrigation | : | 95.76 mcm |
| 21.6 | Category of Block | : | Safe |
| 21.7 | Soil Infiltration factor | : | 10.75% (average of 8 test results) |
| 22 | Ground Water Quality | : | |
| 22.1 | Total Samples collected (nos) | : | Aquifer-1: 424 (Pre:201 & Post:76)<br>Aquifer-2: 242 (Pre:223 & Post:166) |

| | | | | |
|---|---|---|---|---|
| 22.2 | EC, F & $NO_3$ | : | **Aquifer:1** | |
| | | | **Pre-monsoon**<br>EC:367-12130 μS/cm at 25°C; F:0.28 - 2.8 & $NO_3$: BDL - 317 | **Post-monsoon**<br>EC:560-9922 μS/cm at 25°C; F:0.18 - 2.6 & $NO_3$: BDL-135 |
| | | | **Aquifer:2** | |
| | | | **Pre-monsoon**<br>EC:346-11132 μS/cm at 25°C; F:0.23-3.9 & $NO_3$: BDL-320 | **Post-monsoon**<br>EC:418-9922 μS/cm at 25°C; F:0.2-5.0 & $NO_3$: BDL-209 |

| | | | |
|---|---|---|---|
| 23 | GW Related Major Issues Identified | : | Drought Prone Area<br>Shallow depth of weathering<br>Deep water levels (> 20 m)<br>Long term declining trend in water levels<br>Low yield potential<br>Water scarcity during summer months<br>Source sustainability of existing structures<br>Ground water Quality Issues (Geogenic and Anthropogenic)<br>Water Marketing |
| 24 | Sustainable GW Management Plan | : | **Supply side** (On going and proposed)<br>Unsaturated volume available for recharge:10175 MCM, Available surplus runoff :30.8 MCM, Additional recharge with interventions:23.1 MCM<br>(Proposed:777 ARS (PT:7; CD:385 & RS:385))<br>**Demand side**<br>Drip/sprinkler proposed will save 56.86 MCM with this additional 8748 ha can be brought under assured irrigation or Stage of GW extraction can be reduced by 11.5% (from 63.83 to 52.33%)<br>**Institutional:** 2 IEC activities conducted<br>PIP at Daflapur (98 participants)<br>Tier-3 at Jath (108 participants)<br>**Regulatory measures:** Strict implementation of existing act. |

**ABBREVATION:**

| | | |
|---|---|---|
| 2D | : | 2 Dimensional |
| 3D | : | 3 Dimensional |
| ABHY | : | Atal Bhujal Yojana |
| APHA | : | American Public Health Association |
| ARS | : | Artificial Recharge Structures |
| Avg | : | Average |
| BDL | : | Below Desirable Limit |
| BW | : | Bore Well |
| BIS | : | Bureau of Indian Standards |
| CD | : | Check dam |
| CGWB | : | Central ground water board |
| Cr | : | Crore |
| DEM | : | Digital Elevation Model |
| DL | : | Desirable Limit |
| DSA | : | Directorate of Economics and Statistics |
| DTW | : | Depth to water |
| DW | : | Dug well |
| EC | : | Electrical conductivity |
| EL | : | East Longitude |
| EW | : | Exploratory Well |
| F | : | Fluoride |
| FIM | : | Flood irrigation method |
| FP | : | Farm Pond |
| GEC | : | Ground Water Estimation committee |
| GIS | : | Geographic Information System |
| GSDA | : | Ground Water Survey and Development Agency |
| GW | : | Ground Water |
| GWMW | : | Ground Water Monitoring Wells |
| Ha | : | Hector |
| Ham | : | Hector meter |
| HQ | : | Head quarter |
| IF | : | Infiltration Factor |
| ID | : | Irrigated dry |
| INCID | : | Indian National Committee on Irrigation and Drainage |
| ISO | : | International Organization for Standardization |
| Km2 | : | Square kilometre |
| KOW | : | Key Observation Well |
| LPS | : | Liters per second |
| M | : | Meter |
| $M^3$ | : | Cubic meter |
| MM | : | Millimetre |
| m amsl | : | Meters above mean sea level |
| Max | : | Maximum |

| | | |
|---|---|---|
| m bgl | : | Mitres below ground leval |
| MCM | : | Million cubic meters |
| mg/L | : | Milligram per litre |
| MGNREGA | : | Mahatma Gandhi National Rural EmploymentGuarantee Act |
| MI | : | Micro irrigation |
| min | : | Minimum |
| MPT | : | Mini percolation tank |
| MPL | : | Maximum Permissible Limit |
| NCPA | : | National Committee on the Use of Plastics inAgriculture |
| NL | : | North Latitude |
| $NO_3$ | : | Nitrate |
| OCS | : | Over-exploited, Critical and Semi-critical |
| OE | : | Over Exploited |
| OW | : | Observation Well |
| PGWM | : | Participatory ground water management |
| PMKSY | : | Pradhan Mantri Krishi Sinchayee Yojana |
| PPB | : | Parts per Billion |
| PPM | : | Parts per Million |
| PT | : | Percolation tank |
| Pz | : | Piezometer |
| Q | : | Discharge |
| RS | : | Remote sensing |
| RSC | : | Residual Sodium Carbonate |
| SGWD | : | State Ground Water Department |
| S | : | Storativity |
| SAR | : | Sodium Absorption Ratio |
| SY | : | Specific yield |
| T | : | Transmissivity |
| TH | : | Total Hardness |
| USSL | : | US Salinity Laboratory |
| VES | : | Vertical Electrical Sounding |
| WCM | : | Water conservation measures |
| WIMS | : | Water Information Management System |

## CHAPTER-1

# INTRODUCTION

### 1.1 Background:

Aquifer mapping is a multidisciplinary scientific process wherein a combination of geological, hydrogeological, geophysical, hydrological, and water quality data are integrated to characterize the quantity, quality, and movement of ground water in the aquifers. To achieve this goal National Aquifer Mapping on a scale of 1:50,000 was launched by CGWB in 2012 to delineate aquifers, characterize aquifers, and prepare aquifer management plans. This study was very much helpful in identifying suitable areas for ground water based supply schemes, determining the sustainability of ground water development, prioritizing aquifers for managed aquifer recharge, and identifying aquifers for various purposes in regions where new urban centres or industrial hubs are likely to come up, plan integrated ground water recharge schemes, issuing advisories to state agencies on repercussions of continued development of ground water in select areas, and recommendations to state agencies in respect of areas that have prospects for ground water development.

However, National Aquifer Mapping in the first phase was carried out on a large scale in which detailed observations of specific problems related to quantity and quality could not be addressed in detail. So, keeping the above limitations in mind and considering the future requirements, the broad objectives proposed for NAQUIM 2.0 studies were as follows

- Providing information in higher granularity with a focus on increasing the density of dynamic data like ground water level, ground water quality, etc.
- Providing issue-based scientific inputs for ground water management up to the Panchayat level
- Providing printed maps to the users and

- Putting in place a strategy to ensure the implementation of the recommended strategies. Involving state agencies in the studies for a sense of ownership.

NAQUIM 2.0 is designed to provide detailed information to support ground water management decisions at ground level. Since the issues are different in different areas, the studies under NAQUIM 2.0 are proposed as issue-specific and will be undertaken in prioritized focus areas. Broadly 11 Priority areas are identified based on ground water related issues as given below.

| **S. No.** | **Priority Areas** |
|---|---|
| 1 | Water Stressed Areas |
| 2 | Urban Agglomerate |
| 3 | Coastal Areas |
| 4 | Industrial Clusters and Mining Areas |
| 5 | Areas with Springs as the principal source |
| 6 | Areas with Deeper Aquifers |
| 7 | Ground Water Contamination |
| 8 | Auto flow zones |
| 9 | Canal Command Areas |
| 10 | Areas with poor ground water quality |
| 11 | Other specific Issues |

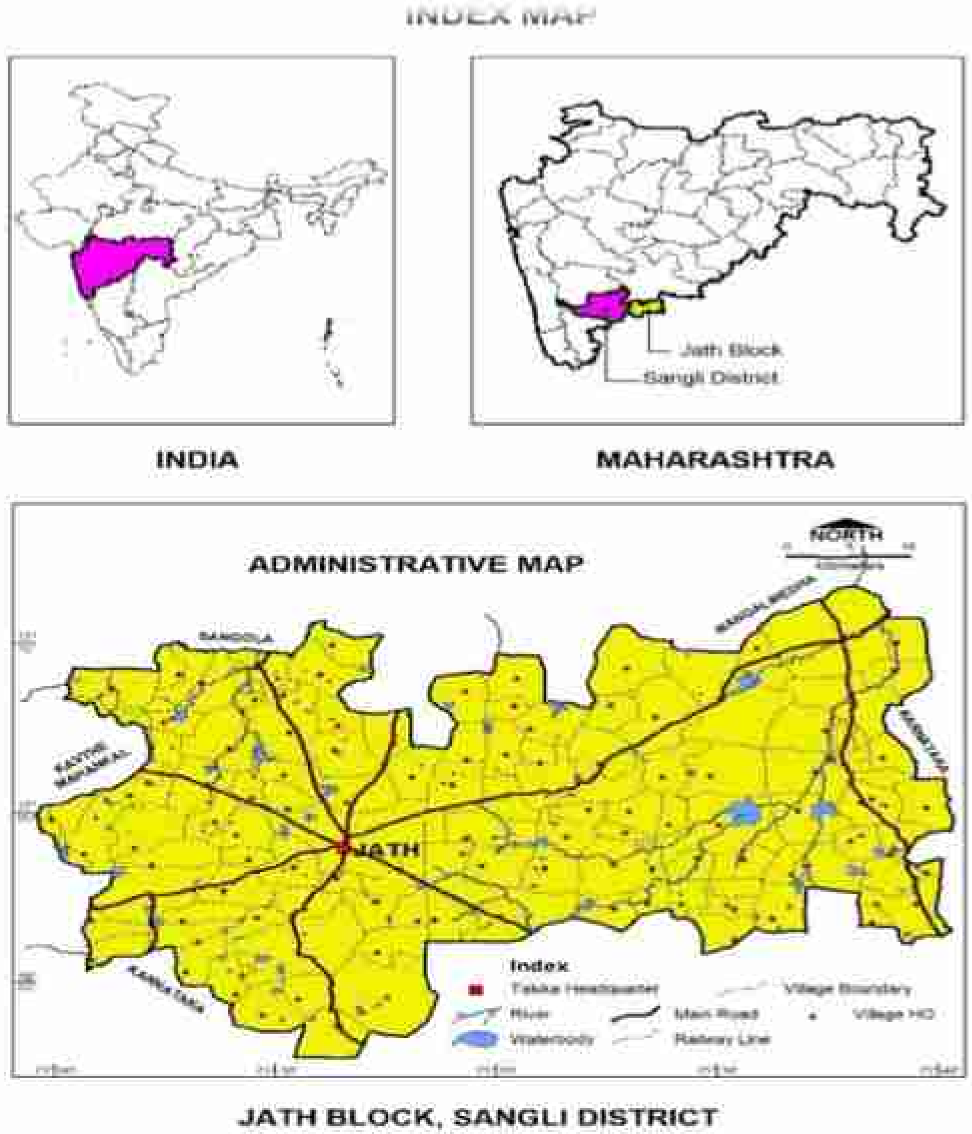
Keeping the above criteria in mind, Jath block of Sangli district was selected under theme "water-stressed areas" for detailed studies under NAQUIM 2.0.

The Jath block of Sangli district, a rain shadow and water stressed area has remained an overstressed block for more than two decades. Low rainfall and less subsurface storage have led to acute water shortage in the lean season with wells drying up from month of January to next monsoon season especially in non-command area. In terms of agricultural production Jath is one of the few blocks of Maharashtra where crops are sown mostly in Kharif season. With increasing ground water extraction, less rainfall, the delicate balance between demand and supply for both drinking and agricultural purposes is dwindling. Non-command area in Jath block especially in eastern side and along Karnataka border has major water scarcity problem. With Bor river flowing on eastern side of block, there is water in dug wells along river bed, but the river is dry even in post-monsoon season due to less rainfall and major artificial recharge structure are also dried up such as anicut, ponds and check dams. The detailed aquifer scenario of Jath block and aquifer-wise management strategies are discussed in the report.

## 1.2 About Study Area (Jath Block):

The Jath block is one of the water stressed block situated in the eastern part of Sangli district bordering Karnataka state on southern and eastern side. Jath block, having an area of 2248 sq km is one among ten blocks of Sangli District and lies between north latitudes 16°50' and 17°19' and east longitude 74°59' and 75°41' covering parts of Survey of India Toposheet No's 47 O/3,4,7,8,11,12, 47 K/16,47 L/13 and 47P/1, 47 P/5 & 47 P/9 (**Figure-1.1**).

The Jath Block having it headquarter at Jath town is bounded by Karnataka state in south and east, Solapur district in north and Kawathe Mahakal Taluka of Sangli District in West. The block, having 125 villages is administratively governed by 116 Gram Panchayats (GPs). The population (2011) of the block is 3, 28,324 and is mainly dependent on agriculture as source of income. The block is part of Bhīma River basin a tributary of Krishna River. The area receives normal rainfall of about 410 mm is predominantly underlain by basalt rock (hard rock). The block has different




geographical, economic and social status. General information of Jath block is given in **Table-1.1**

**Figure-1.1:** Index Map of Jath Block.

**Table-1.1:** General Information, Jath Block.

| | | |
|---|---|---|
| Geographical area | : | **2248 (Sq. km)** |
| Forest area | : | 113.05 (5.03%) |
| No. of Gram Panchayat | : | 116 |
| No. of Villages | : | 125 |
| Population **(Census,2011)** | : | 3,28,324<br>(Males:168256; Females:160068) |
| Climate | : | Dry and Semi-arid |
| Normal/Annual Rainfall | : | 410/341 mm (83 % of normal) |
| Major River | : | Bor a tributary of Bhīma River |
| Drainage pattern | : | Dendritic |
| Soil type | : | Black Cotton and Red soils |
| Major Cropping Pattern (DSA 2022) | : | Jawar(38.57%), Millets (22.22%), Pulses (12.50%), Wheat (2.58%), Sugarcane (7.59 %) Grapes(4.18%) and others fruits (3.25 %). |

## 1.3 Geomorphology, Drainage and Soil Types:

The block is located in the Deccan Plateau and extends west to east direction. The land forms present are erosional broad valley separating flat topped remnant hills, displaying characteristic step like appearance. The surface elevation ranges between 460 and 787 meter above mean sea level (m amsl) in the area, lowest in north-eastern corner and highest in south central part around Jath town. The area of district can be broadly divided into three physiographic units namely,

- Highly dissected Plateau
- Moderately dissected Plateau
- Pediment-Pediplain complex

The Highly dissected Plateau form the ridges in middle of Jath block diving it into two major pediplain complexes, these are also seen in western part of block. Moderately dissected Plateau covers small portion in north-western part of block. Pediment–pediplain complex of denudation origin is a major landform, followed by highly dissected upper Plateau of structural origin and active flood plain at north-west and south-east part. Geomorphology and digital elevation model are presented in **Figure-1.2** and **Figure-1.3**.

The main drainage pattern in the area is dendritic in nature having undulating topography. The Bor river, a tributary of river Bhima flows in eastern part is part of area. A low plateau area is located near Jath block covering about 150 km$^2$ area with another small patch located southwest. Drainage map of area along with categorization of watershed is presented in **Figure-1.4**.

Jath block is occupied by the typical black soil derived from the Deccan traps. Majorly the soils are characterised by black cotton soils having gravely sandy loam and clayey loam texture. The black soil contains high alumina and carbonates of calcium and magnesium with variable amount of potash, low nitrogen and phosphorus. The soil is generally porous and swells considerably on addition of water, and dries up with cracks on losing moisture. Gravelly clay loam and clay loam is also seen in patches. Soil map of the area is given in **Figure-1.5**.

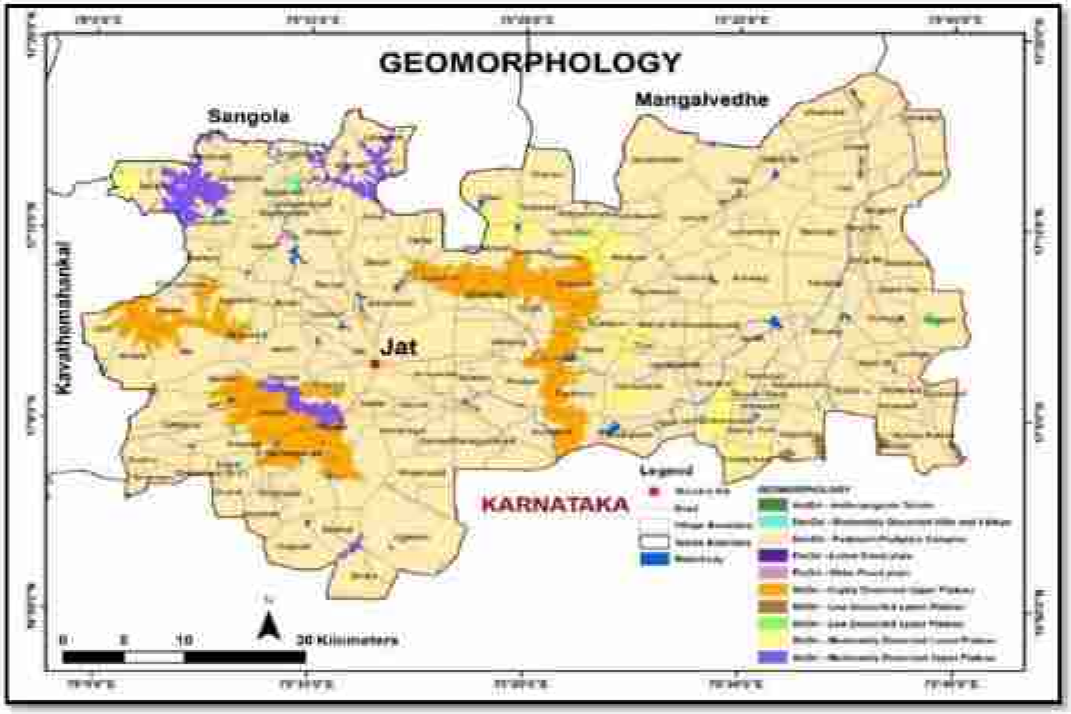



**Figure-1.2:** Geomorphological setup, Jath Block.

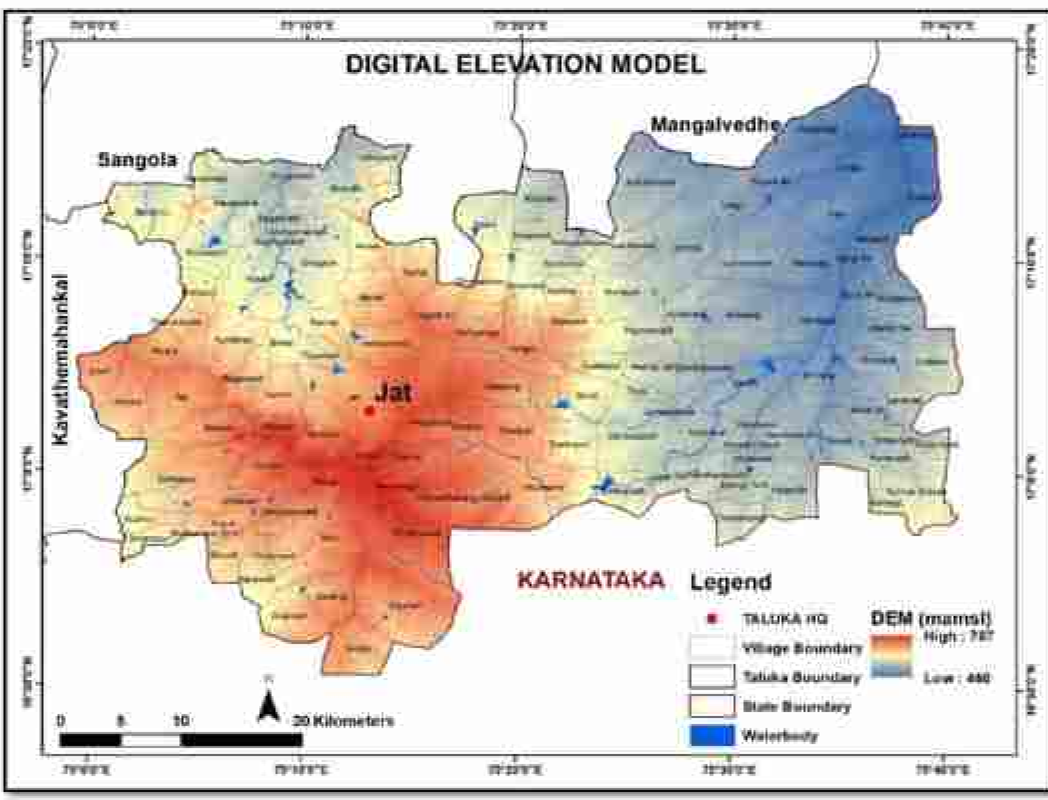



**Figure-1.3:** Digital Elevation Model, Jath Block.

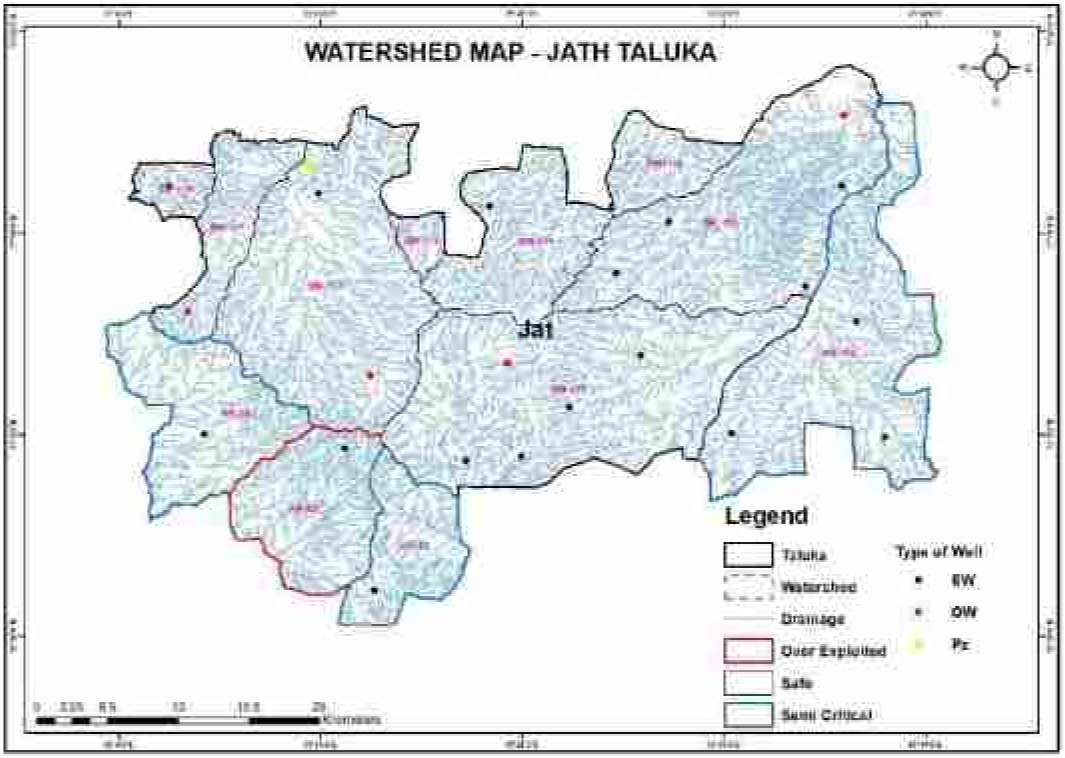



**Figure-1.4:** Drainage pattern, Jath Block.

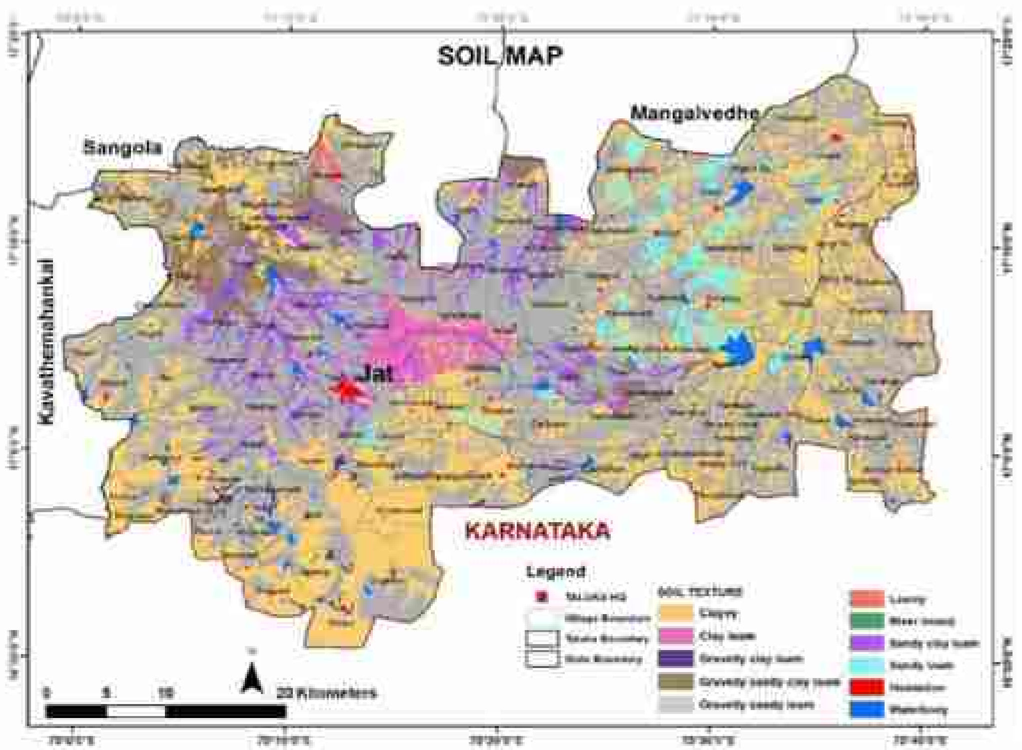



**Figure-1.5:** Soil map, Jath Block.

## 1.4 Rainfall:

Variations in rainfall distribution and occurrence over an area, influences agricultural output of that area, thus analysis of rainfall variability and its patterns is necessary to promote development of water resources and decision making for taking developmental activities. Pre-monsoon-summer (March, April, and May), Southwest monsoon (June, July, August, and September), post-monsoon (October and November), and winter/northeast monsoon (December, January, and February) are the seasons that see the most rainfall.

An amount of precipitation and length of time in an area and ground water draft for various uses, along with type of soils and geology influences dynamics of ground water levels and its availability. Jath block, which receives normal annual rainfall of 410 mm, predominantly receives it during south-west monsoon season (85-90%) and during 2023, it received 341 mm rainfall. Annual rainfall data (1998-2023) is analysed and presented in **Figure-1.6**. From results, it is observed that minimum rainfall occurred during 2012 (106.9 mm) and maximum in 2010 (632.5 mm) (**Table-1.2)**. The area experienced 6 times excess rainfall (23%), 13 times normal rainfall (50%), 4 times moderate droughts (15%) and 3 times severe drought (12%) conditions as given in **Table-1.3**. Rainfall trend analysis shows a falling trend @ 0.31 mm/year. The coefficient of variation of the annual rainfall from the mean rainfall has been observed to be 36%.

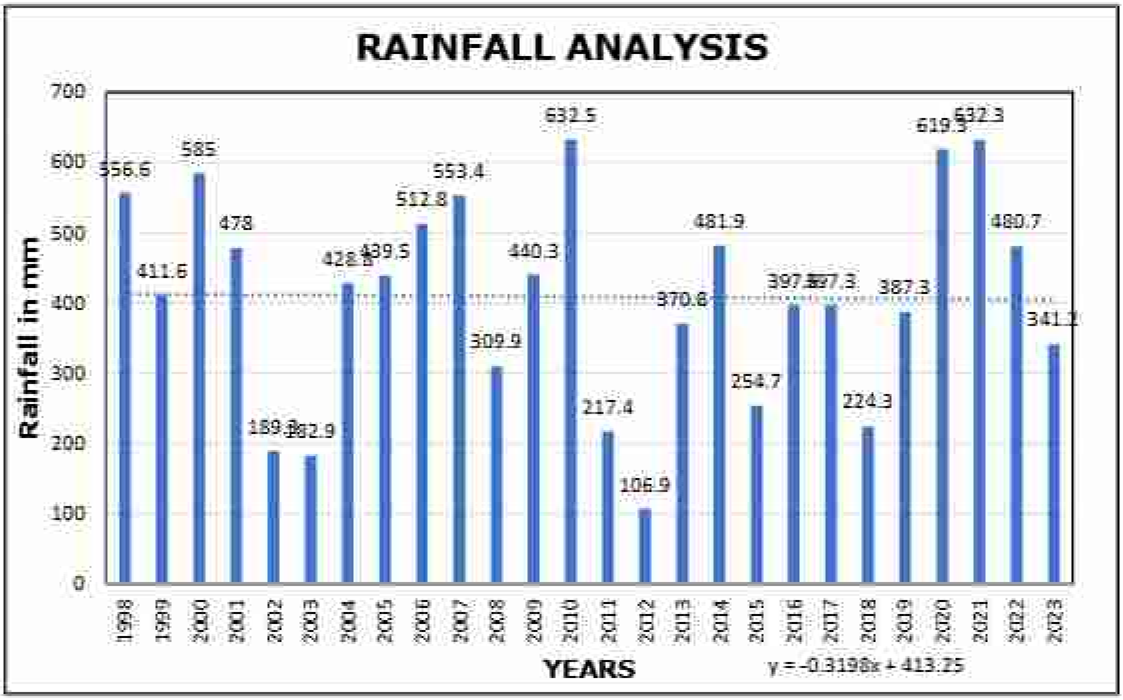



**Figure-1.6:** Annual Rainfall Pattern (1998-2023), Jath Block.

**Table-1.2 :** Long Term Rainfall Analysis (1998 to 2023), Jath Block.

| Year | Annual Rainfall (mm) | Departure (%) | Rainy Days (Nos) | Category |
|---|---|---|---|---|
| 1998 | 556.6 | 33.61 | 52 | Excess |
| 1999 | 411.6 | -1.20 | 36 | Normal |
| 2000 | 585 | 40.42 | 33 | Excess |
| 2001 | 478 | 14.74 | 33 | Normal |
| 2002 | 189.3 | -54.56 | 24 | Severe |
| 2003 | 182.9 | -56.10 | 22 | Severe |
| 2004 | 428.8 | 2.93 | 41 | Normal |
| 2005 | 439.5 | 5.50 | 36 | Normal |
| 2006 | 512.8 | 23.09 | 47 | Normal |
| 2007 | 553.4 | 32.84 | 29 | Excess |
| 2008 | 309.9 | -25.61 | 29 | Moderate |
| 2009 | 440.3 | 5.69 | 43 | Normal |
| 2010 | 632.5 | 51.82 | 52 | Excess |
| 2011 | 217.4 | -47.82 | 33 | Moderate |
| 2012 | 106.9 | -74.34 | 16 | Severe |
| 2013 | 370.8 | -10.99 | 33 | Normal |
| 2014 | 481.9 | 15.67 | 38 | Normal |
| 2015 | 254.7 | -38.86 | 32 | Moderate |
| 2016 | 397.6 | -4.56 | 39 | Normal |
| 2017 | 397.3 | -4.63 | 43 | Normal |
| 2018 | 224.3 | -46.16 | 27 | Moderate |
| 2019 | 387.3 | -7.03 | 51 | Normal |
| 2020 | 619.3 | 48.66 | 64 | Excess |
| 2021 | 632.3 | 51.78 | 75 | Excess |
| 2022 | 480.7 | 15.39 | 56 | Normal |

| | | | | |
|---|---|---|---|---|
| 2023 | 341.2 | -18.10 | 32 | Normal |

**Table-1.3 :** Drought Analysis, Jath Block.

| | | | |
|---|---|---|---|
| Period | 1998 to 2023 | | |
| No. Of Years | 26 | | |
| Normal Rainfall | 410 | | Mean: 408.9 |
| Standard Deviation | 148 | | Median:420.2 |
| Coefficient of Variation | 36.20% | | No of years:26 |
| Slope | -0.31 mm/year | | |
| Intercept | 413.2 | | |
| Equation of Trend Line | | y = -0.3198x + 413.25 | |
| Category | Number of Years | | % |
| Departures | | | |
| Positive | 13 | | 50 |
| Negative | 13 | | 50 |
| Droughts | | | |
| Moderate | 4 | | 15 |
| Severe | 3 | | 12 |
| Acute | 0 | | 0 |
| Normal & Excess R/F | | | |
| Normal | 13 | | 50 |
| Excess | 6 | | 23 |

(Rainfall Departure: Excess: > +25; Normal: +25 To -25; Moderate: -25 To -50; Severe: -50 To -75; Acute: <-75).

## 1.5 Land use & Land Cover:

Agricultural land emerges as the dominant land-use category in the region, highlighting agrarian nature of Jath block. Majority of area is under cropped land followed by fallow land with scrubs. Barren land can be seen in southern side especially at border area of Karnataka. Water bodies occupy a minimal percentage of area. Habitation, which includes infrastructure and urban developments, occupies the area around Jath town, indicating the presence of settlements and human activities. Land use & land cover as per District statistical report is given in **Table-1.4** and presented in **Figure-1.7**.

This diverse distribution of land-use and land-cover classes reflects the varied and dynamic nature of the Jath block, encompassing a blend of agricultural, residential, and natural environments.

**Table-1.4 :** Land use details, Jath Block (after DSA-2023).

| S. No. | Area | Area (Ha) | % with Geographical area |
|---|---|---|---|
| 1 | Geographical Area | 2,24,538 | 100 |
| 2 | Forest Area | 11,305 | 5.03 |
| 3 | Cultivable Area | 1,73,014 | 77.05 |
| 4 | Net Sown Area | 1,64,460 | 73.24 |
| 5 | Double Crop Area | 24,413 | 10.9 |

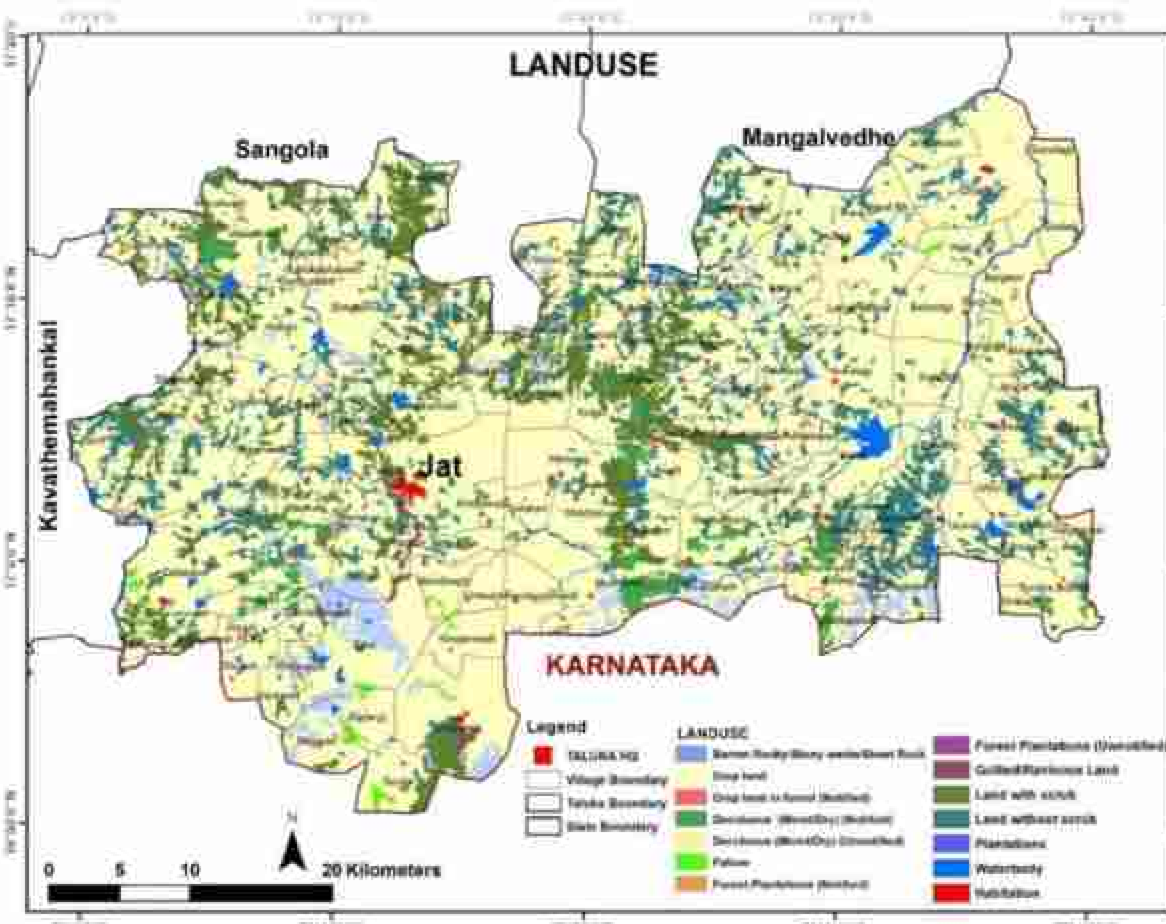



**Figure 1.7:** Land use & Land Cover, Jath Block.

## 1.6 Irrigation:

Irrigation plays a crucial role in enhancing agricultural productivity by providing a reliable and controlled water supply to crops. The establishment of a well-organized irrigation network is vital for ensuring a steady and sufficient water source for farming activities. In the area, there are 2 medium irrigation projects (Dodda nala and Shankh) and more than 24000 irrigation dug wells and about 8933 bore wells. The total command area is 49894 ha and mostly lies in western part and in south-eastern part (**Figure-1.8**). The details of different structures along sources are given in **Table-1.5**. The net irrigated area during 2022-23 from surface water is 19515 ha (major:3070 ha; medium:2467 ha & minor:13978 ha) and from ground water it is 8291 ha (both flood and drip irrigation). These irrigation systems enable farmers to manage water distribution efficiently, catering to the specific needs of different crops and ensuring optimal growth conditions. A well-maintained irrigation network minimizes the dependence on unpredictable rainfall, mitigating risks associated with droughts and dry spells. Moreover, it allows for crop cultivation in areas where natural water sources are limited or irregular. In turn, a reliable irrigation infrastructure contributes significantly to food security, economic stability, and the overall development of the agricultural sector.

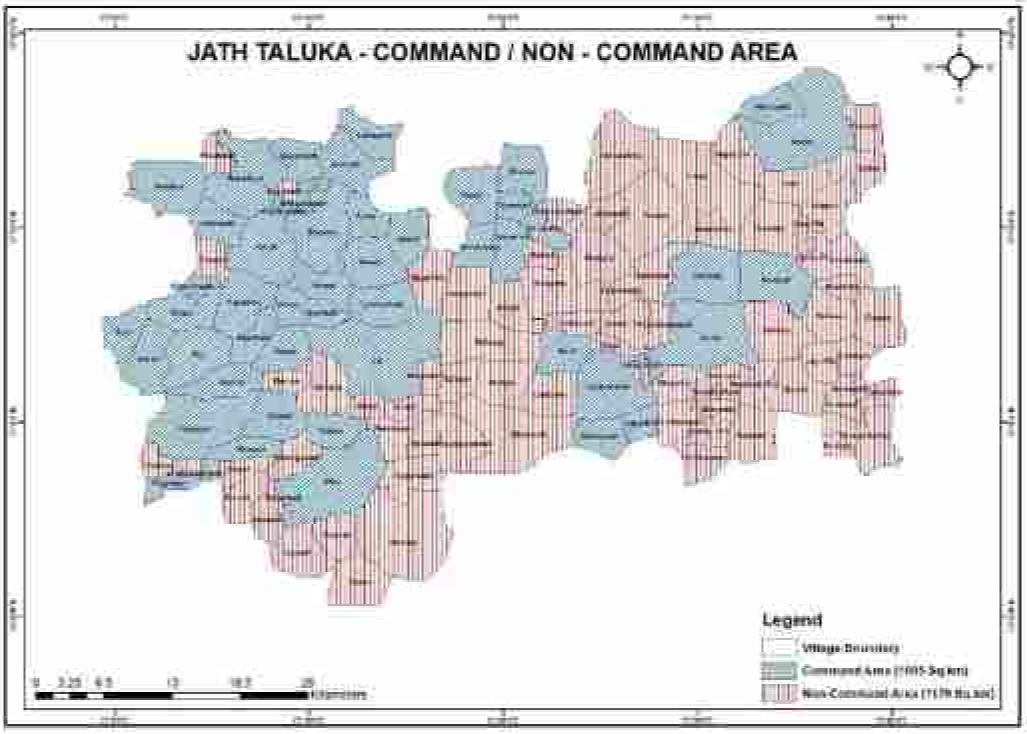



**Figure 1.8:** Command/non-command area, Jath Block.

**Table-1.5:** Area irrigated through different Sources (DSA 23, Sangli).

| **IRRIGATION SOURCE** | | **No.** |
|---|---|---|
| Medium Project | : | 2 |
| Minor Projects | : | 27 state level and 5 local level |
| Storage tanks | : | 173 |
| Percolation Tank (PTs) | : | 188 |
| Kolhapari Bandharas (KT weirs) | : | 41 |
| Dug wells (Irrigation) | : | 21642 (identified from google map) |
| Dug wells (Domestic) | : | 2413 |
| Hand Pumps/Bore wells | : | 8939 |
| Surface Water Irrigation | : | 19515 Ha |
| Ground Water Irrigation | : | 8291 Ha |

## 1.7 Hydrogeological Setup

The occurrence and movement of water in subsurface is broadly governed by geological frameworks i.e.; nature of rock formations including their porosity (primary and secondary) and permeability.

The entire block is underlain by Deccan Volcanic Basalts, belonging to Sahyadri Group of Upper Cretaceous to Eocene age. It comprises various lava flows, which can be classified in the field into two types as simple and compound flows. The compound flows although vesicular and amygdaloidal in nature are hard and compact in their middle sections. The geological map of area is presented in **Figure-1.9**.

These rocks are fractured and jointed, and show moderate degree of weathering at places. The inter trappean beds (red/green/black in colour) constitutes the marker horizons separating two lava flows. The basalts are intruded by dykes at places and are found commonly in pahoehoe flows in the area. The dykes act as barrier or as water conduits/pathways for the movement of ground water flow depending on intensity of fracturing in the dyke rock. The location and orientation of the dykes with respect to the ground water flow are very important.

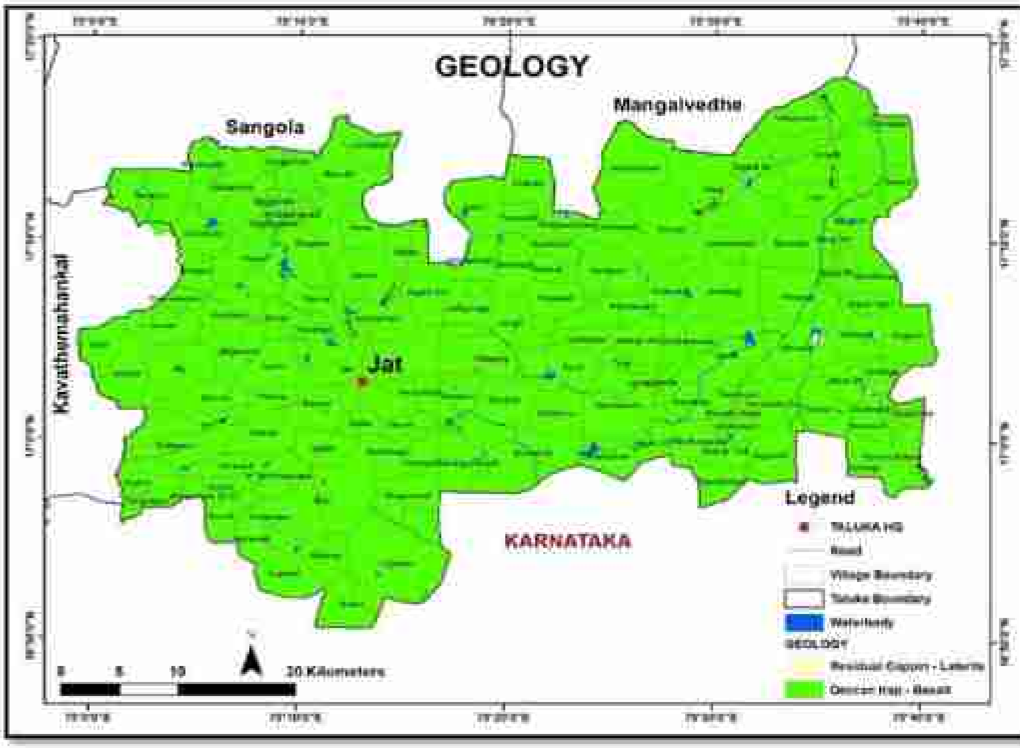



**Figure-1.9:** Geological Map, Jath Block.

In the area, basalt can be divided into two types of formations namely Diveghat and Purandargad formations. The Diveghat formation consists of 10-12 lava flows of alternating "aa" and "pahoehoe" types, varying in thickness from 5 to 40 m. The Purandargad formation comprises essentially of simple lava flows, some of which show both "aa" and "mixed flow" characters. From hydrogeological point of view this formation is not very significant as it occupies the hills and hill slopes (runoff zone) and not potential for development of ground water resources. This formation is predominantly exposed in eastern part of Jath Block.

## 1.8 Ground Water Occurrence:

In basalt, primary porosity is present when the flow is vesicular and vesicles are interconnected with each other and absent in other lava flows. The secondary porosity is developed due to weathering and fracturing over a period of time. The density of vesicles, their distribution, inter-connection, depth of weathering and topography of the area are decision factors for occurrence and movements of ground water in these units. The weathered and fractured trap occurring in topographic lows is the main water bearing formation in the area.

Deccan basalts are hydro geologically in-homogeneous rocks. The weathered and jointed /fractured parts in rocks constitute the zone of ground water storage and flow. The existence of multiple aquifers is characteristic of basalt and is indicative of wide variation in the joint/fracture intensity. The yield from a well is a function of the permeability and Transmissivity of an aquifer and it depends upon the degree of weathering and topographic setting of the aquifer. Due to wide variation in secondary openings, the potential areas for ground water are generally localized. In general ground water occurs under phreatic/unconfined to semi-confined conditions in these rocks.

Ground water occurs under unconfined conditions (up to 30-meter depth) in shallow aquifers and in semi-confined (20 to 40-meter depth) and confined conditions (up to 100-meter depth) in deeper aquifers. Ground water is mainly extracted by bore wells of 60 to 100 m depth. The yield from these bore wells varies from 0.02 to 5 litres/second (lps).

# CHAPTER -2

# PREVIOUS STUDIES

## 2.1 Systematic and Reappraisal Hydrogeological Surveys:

The Central Ground Water Board, Central Region has taken up several studies in the district from the year 1973 onwards. The reconnaissance hydro-geological studies were also undertaken by Shri J.P. Dias in 1973 and Systematic Hydrogeological Surveys were carried out by scientist from Board namely Dr. D.K. Chadha (1975-76); N.G. Gajbhiye & D.K. Chadha (1976-77); N. G. Gajbhiye (1978-79); A R Bhaisare (1978-79); S K Jain (1987-88); P.K. Naik and B.K. Kallapur (1988-89). The district ground water report was compiled by S. Das and D.B. Shety in 1981. The ground water exploration was also carried out in parts of district under Sina-Man project of CGWB during the year 1975-80.

## 2.2 National Aquifer Mapping (NAQUIM) Studies:

Under National Aquifer Mapping studies, studies were taken up during Annual Action Plan (AAP) 2017-18, by CGWB, SUO, Pune in Sangli district including present study area. The salient points from study are given below.

- The taluka receives an annual rainfall of 605 mm and the estimated annual extractable ground water resource is 25971.36 ham, the water draft for all uses is 17558.2 ham, the net annual ground water availability for future irrigation Use is 9250.04 ham with overall stage of ground water extraction of 67.60 %.
- Studies reveals, 2 aquifer system in Jath block, i.e., Aquifer-1 consisting of weathered/fractured basalt having a depth range of 9-18 m and Aquifer-2 consisting of mainly jointed/fractured basalt having a depth range of 60-190 m depth. Thickness of weathered basalt ranges from 5.4-14 m and fractured basalt thickness varies from 1 to 7 m.
- In the report, total 5513.15 MCM of unsaturated volume is estimated, based on it, as supply side management strategy, interventions were proposed, which includes construction of 274 check dams and 96

percolation tanks and is expected that 20.54 MCM of ground water is expected to be recharged.

- As demand side management strategy, micro irrigation and drip irrigation is proposed and through which, 3.99 MCM of ground water can be saved. Further, in the report, in order bring additional area under irrigation construction of 1506 ground water abstraction structures are proposed which includes 1291 dug wells and 215 bore wells and through which additional 3309 ha area can be brought under assured irrigation.

### 2.3 Ground water Exploration Studies:

The Central Ground Water Board, through its exploratory drilling program from different phases, drilled 13 wells (EW:11 and OW:2) down to 186.4-200 m depth and carried out 9 vertical electrical sounding in Jath block. Summarised details are given in **Table-2.1**.

**Table-2.1:** Exiting Exploratory well data, Jath Block.

| Village | Type | Latitude | Longitude | Depth | Casing | Water Level | Zones tapped | Yield |
|---|---|---|---|---|---|---|---|---|
| | | | | | (m bgl) | | | lps |
| Darikonur | EW | 17.022 | 75.373 | 200 | 29.5 | 145 | 47.3-50.4, 187-90.7 | 0.07 |
| Kontev Boblad | EW | 16.998 | 75.634 | 200 | 17.5 | 150 | 87-90 | 0.07 |
| Yelvi | EW | 17.207 | 75.307 | 200 | 29.5 | 150 | 23-26, 163.2-166 | 0.07 |
| Ravalgundwadi | EW | 16.978 | 75.287 | 200 | 29.5 | 150 | 87-90, 178-181 | 0.07 |
| Halli | EW | 17.202 | 75.581 | 186.4 | 17.5 | 57.4 | 61 | 4.43 |
| Karajgi | EW | 17.121 | 75.575 | 200 | 5.8 | 5.1 | 47-48, 70-71 | 5 |
| Madgyal | EW | 17.135 | 75.417 | 200 | 5.2 | 30 | 44-45, 61-62 | 0.78 |
| Mokashiwadi | EW | 17.196 | 75.167 | 200 | 5.8 | 12 | 111-114, 178-179 | 2.16 |

| Village | Type | Latitude | Longitude | Depth | Casing | Water Level | Zones tapped | Yield |
|---|---|---|---|---|---|---|---|---|
| Muchandi | EW | 16.982 | 75.333 | 200 | 5.8 | 5.5 | 24-25,<br>75-76 | 0.78 |
| Umadi | EW | 17.058 | 75.3211 | 200 | 5.75 | 15.2 | 111-112 | 4.77 |
| Umadi | OW | 17.135 | 75.4172 | 117 | 5.65 | 12 | 110-111 | 0.78 |
| Valsang | EW | 17.179 | 74.990 | 159.9 | 5.65 | 35 | 92.8-101,<br>141-142 | 2.16 |
| Valsang | OW | 17.195 | 75.166 | 159.9 | 5.65 | 35 | 92.8-101 | 0.43 |

## 2.4 Other Studies:

A research paper (Agricultural problems and prospects of drought prone region in sangli district of Maharashtra) published by Pawar, D.H. and Jadhav K.R. (2012), focusses on agricultural and prospects of drought prone region of Sangli district and suggests for improvement in irrigation along with watershed development programs in the area. Shivaling B. Rajmane, 2019, Patil et. Al., 2019, Raut et. Al., 2019, V. M. Dikshit, 2020, which mainly covers different parts of Sangli District focus on agricultural and irrigational problems, ground water recharge, agrarian land utilization and its circulation, occurrence and movement of ground water, utility of RS and GIS technique in delineating potential ground water recharge zones as a base for further artificial recharge, water management and soil conservation.

According to Down to Earth News, drought has again hit large parts of Maharashtra this year. But the worst affected are two talukas are Jath and Atpadi of Sangli district. These blocks are facing the worst drought in decades, despite the river Krishna is flowing 100 km away. Analysts and thinkers blame the plight on poor management of ground water and lax attitude of the state government in extending irrigation facilities to the region that falls in the rain shadow area of the Western Ghats. Traditionally they grow sorghum, pearl millet and wheat that require less water. But some two decades ago, lured by the profits earned by farmers in western Sangli, which has adequate irrigation facilities from the Krishna Valley project, Jath and Atpadi farmers began growing cash crops. "Commercial cultivation of these crops forced them to over-exploit ground water". Within years, the talukas notched a place in the World map for pomegranate producing areas. But, since the year 2005, the region has been witnessing a drastic change in rainfall pattern and experts advise that it is high time that the government undertake long-term water management in this rain shadow region. The other suggestion includes, aquifer recharge deepening and widening of existing streams, nullahs and water bodies etc and this will serve two purposes-accommodate additional water during floods and release stored water during crisis.

# CHAPTER -3

## OBJECTIVES OF THE PRESENT STUDY

As per NAQUIM 2.0 Tool Kit, following deliverables are defined for the theme: Water Stressed Areas and each deliverable can be achieved through various data inputs, its processing and output through various GIS based layers.

| S. No. | Theme: Water Stressed Areas (Deliverables) |
|---|---|
| 1 | Aquifer Disposition |
| 2 | Aquifer wise ground water levels |
| 3 | Delineation of recharge areas |
| 4 | Estimation/Refinement of parameters used for resource assessment |
| 5 | Assessment of ground water resources |
| 6 | Ground water quality |
| 7 | Areas showing signs of subsidence |
| 8 | Ground water quality management interventions including demarcation of safer aquifers |
| 9 | Artificial recharge plan |
| 10 | Other measures |
| 11 | Identification of potential aquifers for drinking water supply |
| 12 | A plan for drinking water source sustainability |

### 3.1 Aquifer Dispositions:

The delineation of aquifer disposition can be carried out by doing systematic studies, which involves input of various data, data processing and final out put through various GIS maps, charts, tables, 3-D models, fence diagram/sections etc.

**Major Inputs:** The primary goal of this deliverable is to obtain a comprehensive understanding of the aquifer disposition in the study area. The process involves detailed geological/hydrogeological and geophysical studies to map out an aquifer characteristics such as their size, shape, depth and extent of weathered zone/fractured zone. Weathering refers to the breakdown of rocks into smaller particles, and its thickness can greatly influence the storage and movement of ground water. Fracturing of rocks occur due to various stresses that are created on the rocks and as a result, these rocks get fractured leading to more permeability and porosity. By mapping this weathered/fractured thickness, helps in identifying potential zones for development and for taking recharge measures. The other inputs include, carrying out long duration pumping tests for knowing aquifer properties like transmissivity, storativity, specific yields etc. collecting and analysing aquifer wise ground water levels and ground water quality data, field exposure visits, collecting farmers feedback etc.

**Data Processing and Outputs:** In this process, data collected is entered initially in required format (excel; csv, txt etc). The data is processed by using advance software's like Rockworks, Map info, ArcGis, AquaChem etc. Before finalizing the data/maps are cross checked with field lithologs/geophysical logs.

### 3.2 Aquifer-wise Ground Water Levels:

The major inputs for this deliverable is collecting historical data, establishing new key wells in different aquifers and monitoring them at periodic intervals, determinations of their reduced levels. Creation of water digital elevation model (DEM), etc. Understanding seasonal and annual changes in ground water levels is crucial for assessing the aquifer's health conditions, recharge rates, and their sustainability. It also helps in developing models to predict future changes in water availability and to plan accordingly for sustainable ground water resource management.

The data is processed by using advance software's and by carrying out statistical analysis including time series analysis, preparation of maps using standard contour methods, long term trend analysis etc. The output will be aquifer wise depth to water level maps, contour maps, map showing water level trends, preparation of hydrographs etc.

### 3.3 Delineation of Recharge Areas:

Identifying areas where ground water recharge is naturally occurring, as well as those that could benefit from artificial recharge, is essential. This involves examining soil types and their texture, topography, and existing water flow patterns. The final output of this deliverable is generation of map showing major recharge areas along with detailed artificial recharge plan, which may include structures like percolation tanks, recharge wells, and check dams designed to enhance the natural replenishment of aquifers.

### 3.4 Estimation/Refinement of Parameters Used for Resource Assessment:

Accurate estimation of parameters such as canal seepage factors and seepage from ponds is crucial for assessing the overall ground water resources. This aspect of the study will refine these parameters using both field measurements and modelling techniques, farmers feedback thereby improving the reliability of water resource assessment. It aims to provide a better quantification of the available ground water and the contribution of various sources to aquifer recharge. The data processing in this involves, carrying out sample survey on unit draft, infiltration studies for estimation of rainfall infiltration factor, slug tests etc. The outcome of this deliverable is generation of various maps, tables showing aquifer wise parameters that are to be integrated with aquifer dispositions maps and tables.

### 3.5. Assessment of Ground Water Resources:

This deliverable involves, carrying out ground water assessment by following standard GEC methodology (2015). The inputs required is data on water levels, ground water draft (irrigation/domestic/industrial), return flow from irrigation, recharge form canal seepage, recharge from various artificial recharge structures etc. The data processing and final output involves data entry and processing recharge and discharge and stage of ground water extraction etc at block/watershed level.

### 3.6 Ground Water Quality:

Assessing the quality of ground water is as important as assessing its quantity. As quality of ground water is vital for ensuring its safety for human consumption and other uses. This part of study involves collection of historical data, published literature, collection and analysis of water samples from different aquifers to measure parameters such as pH, salinity, hardness, other major cat ions and an ions and presence of major heavy metals. The data gathered will guide in formulating management practices and to address quality issues, if any and to maintain the standards required for drinking water. The data processing involves statistical, time series analysis, generation of hydrochemical diagrams, variation diagrams etc. The output will be through various maps with the concentration attributes, contouring, description of probable sources and release mechanism preparation of vulnerability map, ground water quality hotspots etc.

### 3.7 Areas Showing Signs of Subsidence:

In order to deliver this deliverable, published literature from the area, along with signs of subsidence observed during field is to be considered. The data processing involves, analysis of satellite data with published literature and field observations. The final output will be a map showing zones of land subsidence with relevant attributes.

### 3.8 Ground water Quality Management Interventions Including Demarcation of Safer Aquifers:

Not all aquifers are equally suitable for providing drinking water due to differences in water quality and yield. This objective entails identifying which aquifers have the potential to serve as reliable and safe sources of drinking water. It involves both quantity and quality assessments and considering the sustainability of extracting water from these aquifers.

### 3.9 Artificial Recharge Plan:

This deliverable requires, analysis of Shuttle Radar Topography Mission (SRTM), toposheet & satellite data along with input of hydrogeological data like specific yield, rainfall infiltration factor etc. The data processing involves, preparation of piezometric head, weathered zone and land form maps. The final outcome of this deliverable will be preparation of feasible areas for artificial recharge, type of artificial recharge structures (ARS) suitable along with its design etc.

### 3.10 Other Measures:

The major input in this deliverable is demand side water requirement for crops. The data processing involves, irrigation water demand for irrigated crops, irrigated dry (ID) crops, field truthing etc. The final output of this deliverable is preparation of demand side management plans with required attributes.

### 3.11 Identification of Potential Aquifers for Drinking Water Supply:

For identification of this deliverable, data input required is data on aquifer geometry & their properties, farmers feedback, ground water levels & quality data etc. The data processing involves generation of maps showing areas with assured irregular and no water supply. The output will be generation of ground water potential, ground water quality maps free from contamination (both geogenic & anthropogenic etc.

### 3.12 A Plan for Drinking Water Source Sustainability:

Final aim of NAQUIM is to ensure long-term sustainability of drinking water sources and this requires a strategic planning that includes both protection & sustainable use of ground water. It focuses on demand-side management interventions. The plan will also include public education campaigns (IEC activities), policy recommendations, and the integration of water-saving technologies etc.

# CHAPTER-4

# AQUIFER DISPOSITIONS

## 4.1 Data Collection and Data Generation:

During AAP 2017-18, under NAQUIM-1 studies from Jath block, data on exploration, geophysical surveys and water-level (shallow aquifer) etc was generated on 1:50,000 scale. The Details of data requirement, data availability and data gap are tabulated in **Table-4.1**. During the present studies, a detailed work on following items is carried out by generating additional datasets as per **Table-4.2.**

a) Delineation of all waterbodies.
b) Spatial distribution of Artificial recharge structures (CDs/PT/KT weir) identified through imagery analysis in google earth.
c) Delineation of Canal and canal Command area.
d) Calculation of Evapotranspiration losses.
e) Village wise number of ground water abstraction structures (both irrigation and domestic use).
f) Data on depth of weathering/fracturing, draft, discharge etc. collected during field visits.
g) To know spatial distribution of recharge rates, soil Infiltration studies were carried out in different geomorphic units.

Location of existing data, data generated and data used for deciphering aquifer geometry is plotted on **Figure-4.1, Figure-4.2 and Figure-4.3** respectively.

**Table 4.1:** Details of data requirement, data availability and data gap.

| S. No. | Data on | Data Requirement | Data Availability | Data Gap |
|---|---|---|---|---|
| 1 | Rainfall | Rainfall distribution | CHIRPS Dataset | No Data Gap |
| 2 | Soil | Distribution of soils and their infiltration rates. | 1:200000 | Yes |
| 3 | Land use | Latest Land Use pattern | Available for year 2023 | No Data Gap |
| 4 | Geomorphology | Digitized Geomorphological map | Downloaded from NRSC, ISRO, Hyderabad. | No Data Gap |
| 5 | Geophysics | Data in each Quadrant | Nil | Yes |
| 6 | Exploration Data | Data in each Quadrant with Aquifer Parameters | 11 EW's | Village-level datasets to be generated. |
| 7 | Aquifer Parameters | Aquifer parameters for all quadrants | Only 50 % wells | Yes |
| 8 | Recharge Parameters | Recharge parameters for different soil and aquifer types based on field studies | Available in Resources Estimation Methodology | 100 % data gap |
| 9 | Discharge Parameters/ Draft Data | For different ground water abstraction structures | Available on 1:50,000 Scale | Village-level discharge data required. |
| 10 | Geology | on 1:50,000 Scale. Hard and digitized copies. | Available as hard copies. | Soft copies to be generated. |

**Table-4.2:** Additional data generated during NAQUIM-2.0 Studies.

| S. No. | Items | Data Generated |
|---|---|---|
| 1 | Rainfall Data | Updated data collected |
| 2 | Geophysical data | 46 geophysical surveys (VES) carried out |
| 3 | GW Exploration | Constructed additional 10 EW and 2 OW and 1 Pz. Conducted 2 long duration pumping tests for the determination of Aquifer parameters. |
| 4 | GW Regime Monitoring | • Established 456 key wells from both aquifer-1 and aquifer-2 for analyzing water-level behaviour of weathered and fractured aquifers.<br>• Data from existing 5 monitoring wells also used. |
| 5. | GW Resource Refinement | Unit Draft data was generated by analyzing the cropping pattern of Kharif and Rabi through Remote sensing and GIS studies. |

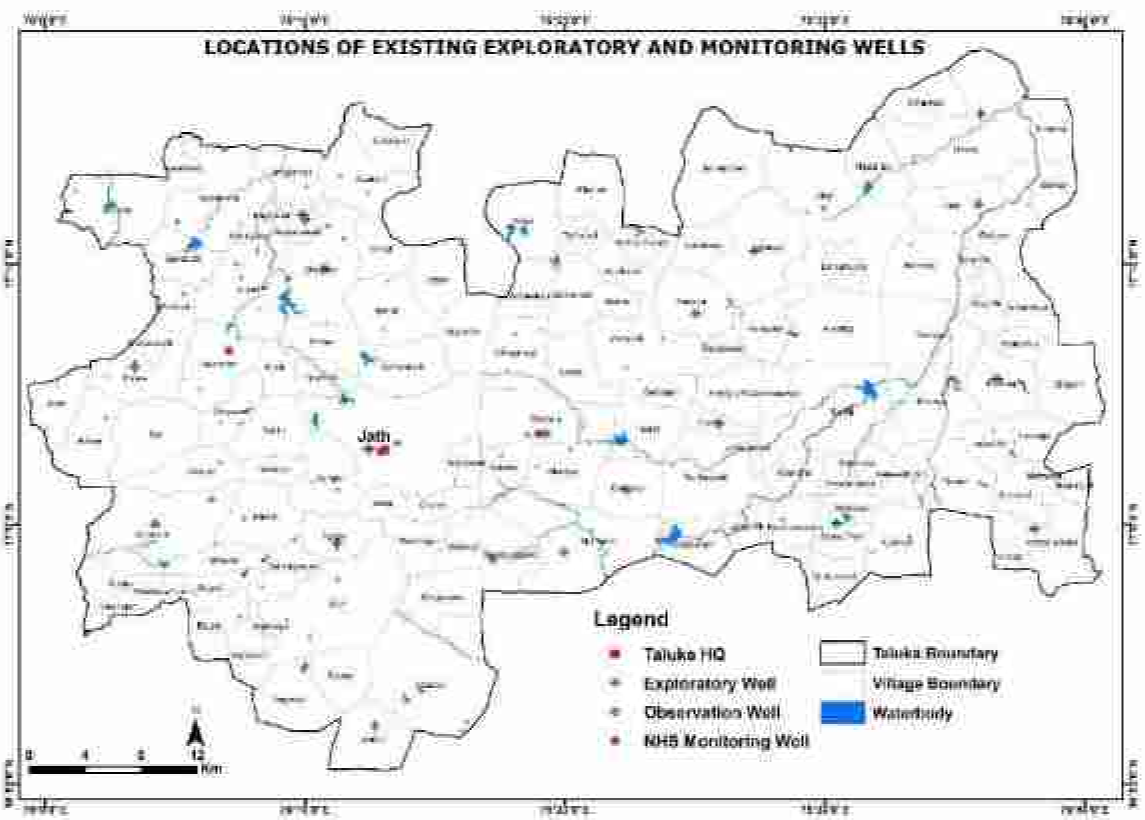



**Figure-4.1:** Locations of existing exploratory & monitoring wells.

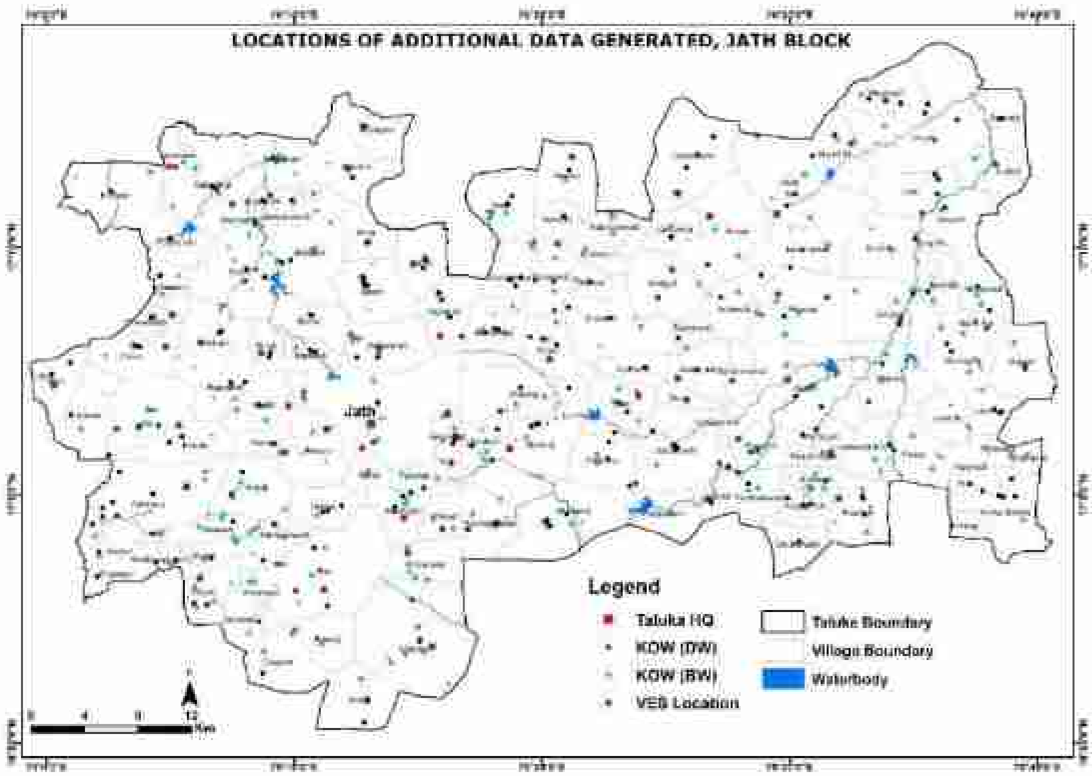



**Figure-4.2:** Locations of additional data generated sites, Jath block.

## 4.2 Objectives:

Primary objective of NAQUIM studies is delineation of aquifer disposition both vertically and horizontally and to identify their hydraulic properties. This includes defining lithological boundaries, mapping stratigraphic layers and determining the geometry of aquifer units. Decision-making regarding aquifer disposition objectives also involves considerations for ground water flow and contaminant transport analyses.

The goal of an aquifer test is often to determine key aquifer properties, such as hydraulic conductivity, transmissivity, and storativity. These objectives guide the selection of appropriate testing methods, including pumping rates, well configurations and monitoring well locations. Additionally, aquifer tests may aim to assess the aquifer's response to stresses, such as variations in pumping rates, to understand its dynamic behaviour and recharge capacities. This objective can be further extended in evaluating well efficiency, identifying potential aquifer boundaries, and estimating sustainable pumping rates for water supply wells.

### 4.3 Material and Methods:

Determining disposition of an aquifer in an area, typically involves a multi-step methodology combining various geological, hydrological, and geophysical techniques. Here's a generalized methodology is given for finding out aquifer disposition.

i. **Geological Mapping:** Conduct field surveys to map the geological formations in an area.

ii. **Hydrogeological Assessment:** Collect data on existing wells, boreholes, conduct pump tests to determine aquifer properties such as transmissivity, specific yield/storage coefficients etc.

iii. **Geophysical Surveys:** To know layer wise depth of weathering zone by conducting vertical electrical sounding (VES).

iv. **Field Investigations:** Conducting additional field investigations such as test drilling or borehole logging to validate findings from remote sensing and geophysical surveys. If required collecting aquifer material samples for laboratory analysis to determine hydraulic conductivity and porosity.

v. **Aquifer Disposition:** Integrating all data collected and by using advance software's such as Rockworks and to develop 3D model, 2D model and stratigraphic section of the block.

In order to decipher aquifer disposition, the software, Rock Work's was used. This software allows integration of diverse data types, such as borehole logs, geophysical surveys and hydrogeological measurements, to facilitate a holistic understanding of an aquifer disposition. It also offers tools for interpolating and modelling these parameters in three-dimensional space, aiding in creation of accurate hydrogeological models. By setting clear objectives, users can tailor Rockwork's to generate visual representations, cross-sections and volumetric calculations that align with specific project goals.

## 4.4 Results and Discussion:

### 4.4.1 Ground Water Exploration

Total 13 number of exploratory wells were drilled in NAQUIM-I studies and under NAQUIM-2.0 studies additional 11 Exploratory wells and 2 observation wells were drilled. The salient features of drilling results are given in **Table-4.3** and plotted on **Figure-4.3**.

**Table-4.1:** Details of wells drilled in Jath block.

| S. No. | Village | Type | X | Y | Depth/ depth of casing | Water Level | Zones tapped | Yield | Transmissivity (T)/Storativity (S) |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | (m bgl) | | | lps | $m^2$/day/Nil |
| 1 | Bevanur | EW | 17.2050 | 75.0422 | 200/20.5 | 148 | Nil | Wet | |
| 2 | Hivare | EW | 17.1012 | 75.0574 | 200/23.5 | 8.1 | 22.6-25.7, 80.6-83.6, 135.5-138.5 | 4.43 | |
| 3 | Hivare | OW | 17.1012 | 75.0573 | 151/23.5 | 4.8 | 22.6-25.7, 80.6-83.6, 135.5-138.5 | 4.43 | 27/0.00012 |
| 4 | Dafalapur | EW | 17.0001 | 75.0708 | 200/42 | 36 | 193-196 | 0.03 | |
| 5 | Sindur | EW | 16.8707 | 75.2118 | 200/20.5 | 34 | 166-169 | 0.03 | |
| 6 | Yeldari | EW | 16.9882 | 75.1870 | 200/20.5 | 56 | 13-15, 71-74 | 0.03 | |
| 7 | Jath | EW | 17.0485 | 75.2079 | 200/15.5 | 26 | 13-15, 74-76 | 4.43 | |
| 8 | Jath | OW | 17.0484 | 75.2079 | 200/15.5 | 23 | 13-15,74-77 | 4.43 | 50/0.0002 |
| 9 | Asangi turk | EW | 17.0008 | 75.5071 | 200/15.5 | 13 | 44-47,162-166 | 0.14 | |
| 10 | Tilyal | EW | 17.0650 | 75.4318 | 200/20.5 | 36 | 72-74 | 0.14 | |

| S. No. | Village | Type | X | Y | Depth/ depth of casing | Water Level | Zones tapped | Yield | Transmissivity (T)/Storativity (S) |
|---|---|---|---|---|---|---|---|---|---|
| 11 | Sonyal | EW | 17.1757 | 75.4548 | 200/20.5 | Dry | Nil | Wet | |
| 12 | Morbagi | EW | 17.0933 | 75.6104 | 200/20.5 | 30 | 171-172 | 0.14 | |
| 13 | Singanhalli | Pz | 17.2224 | 75.1553 | 120/20.5 | 7 | 7-8, 77.5-80.6 | 0.14 | |

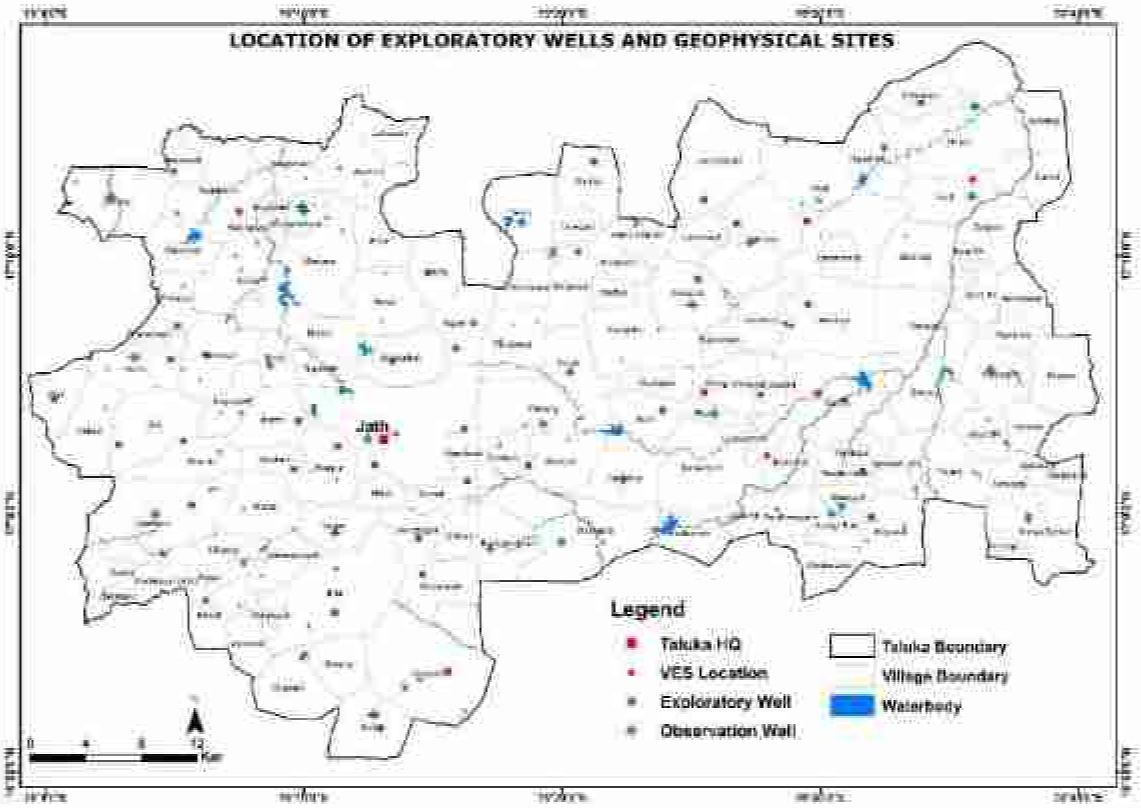



**Figure-4.2:** Location of Exploratory wells and Geophysical Sites.

### 4.4.2 Electrical Resistivity Surveys

Vertical Electrical Sounding (VES) was carried out at 46 locations to identify the vertical distribution of ground electrical resistivity (**Figure-4.4**). The true resistivity and true thickness of geoelectrical layers were obtained and were used to explain different inferred lithology. From the detailed study of inferred lithology, interpreted results infer that, the resistivity of top geoelectric layer varies between 2.5 to 525 ohm-m having thickness between 0.4 to 7.09 m and corresponds to top soil. The geoelectric layer with resistivity varying between 2.315 to 66.2 ohm-m and thickness between 1.63 to 41.8 m corresponds to weathered basalt. The geoelectric layer with resistivity varying between 12.4 to 76.4 ohm-m and thickness between 3.57 to 177.4 m corresponds to moderately weathered/fractured/vesicular basalt. The geoelectric layer with resistivity varying between 14.3 to 69.4 ohm-m and thickness between 8.5 to 105 m corresponds to inter-trapian vesicular basalt. The geoelectric layer with resistivity varying between 65.6 to 21626 ohm-m towards the bottom corresponds to Massive Basalt. Litho unit data from VES is presented in **Table-4.4**.

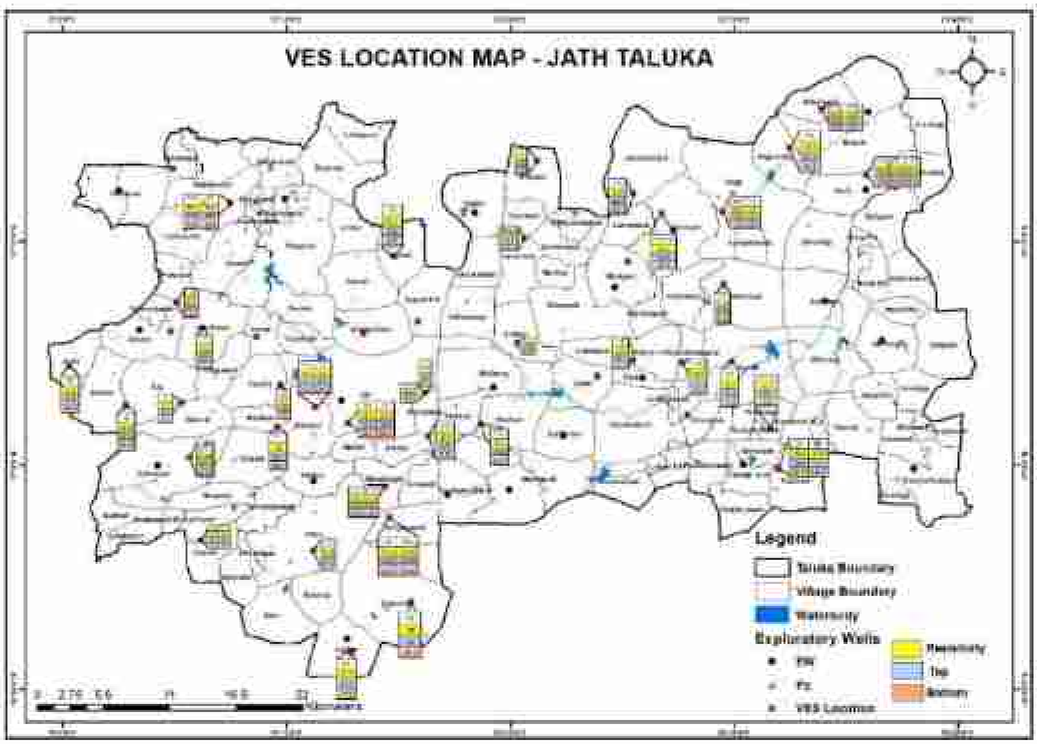



**Figure-4.4:** VES Locations, showing resistivity & thickness of top & bottom layer.

**Table-4.4:** Inferred litho unit data from Jath Block.

| **Resistivity** | | **Inferred litho units** | **Thickness (m)** | |
|---|---|---|---|---|
| From | To | | From | To |
| 2.5 | 525 | Top Soil | 0.394 | 7.09 |
| 2.315 | 66.2 | Weathered Basalt | 1.63 | 41.8 |
| 12.4 | 76.4 | Moderately Weathered/Fractured/Vesicular Basalt | 3.57 | 177.4 |
| 14.3 | 69.4 | Vesicular Basalt | 8.51 | 105 |
| 65.6 | 21626 | Massive Basalt | | |

**Inferences:**

- The density of vesicles, their distribution, inter-connection, depth of weathering and topography of area are decision factors for occurrence and movements of ground water in these units.
- Out of 46 VES curve types, 18 are of four layers, 18 are of five layers and remaining 10 are of three layers.
- Computed inverse resistivity models suggest presence of potential ground water zones at many VES locations. Weathered mantle, inter-trappean and fractures concealed within traps and at different depths.
- All VES curves associated with H-type curve, indicates water potential sites. Moreover, VES curves (VES 6,7,8,14) are associated with A-type which refers to hard rock terrain indicating no ground water potential zone at these locations.
- QH-type curve which is 10% (VES 1,15,16) is dominant in four-layer models, indicating hard lithology overlain by soft strata, thereby a good indicator for ground water potential zone.
- In the five layers KHK is the major curve type, it indicates weathered sections favorable for ground water (VES 10,11,28,29).

- The inter-trappean vesicular basalt lithology, layers containing VES no 3,4,10,13,15,16,20,22,30,31,35,37,44 and 46 may act as a good indicator for ground water potential zone.

### 4.4.3 Shallow Aquifer (Aquifer-1)

In the area, 226 dug wells from shallow aquifer (Dug well zone) (**Aquifer-1**), whose depth of varies between 4.5 to 30 m were inventoried (**Figure-4.5a-c**). This zone, in most part of area has been de-saturated and as a result most of dug wells goes dry during January to May months of each year. The details of well inventory carried out is given in **Annexure-1**. Based on exploratory data and geophysical data, weathering map of area is prepared an presented in **Figure-4.6.**

**Figure-4.5a-c:** Depth of weathering, Jath Block.

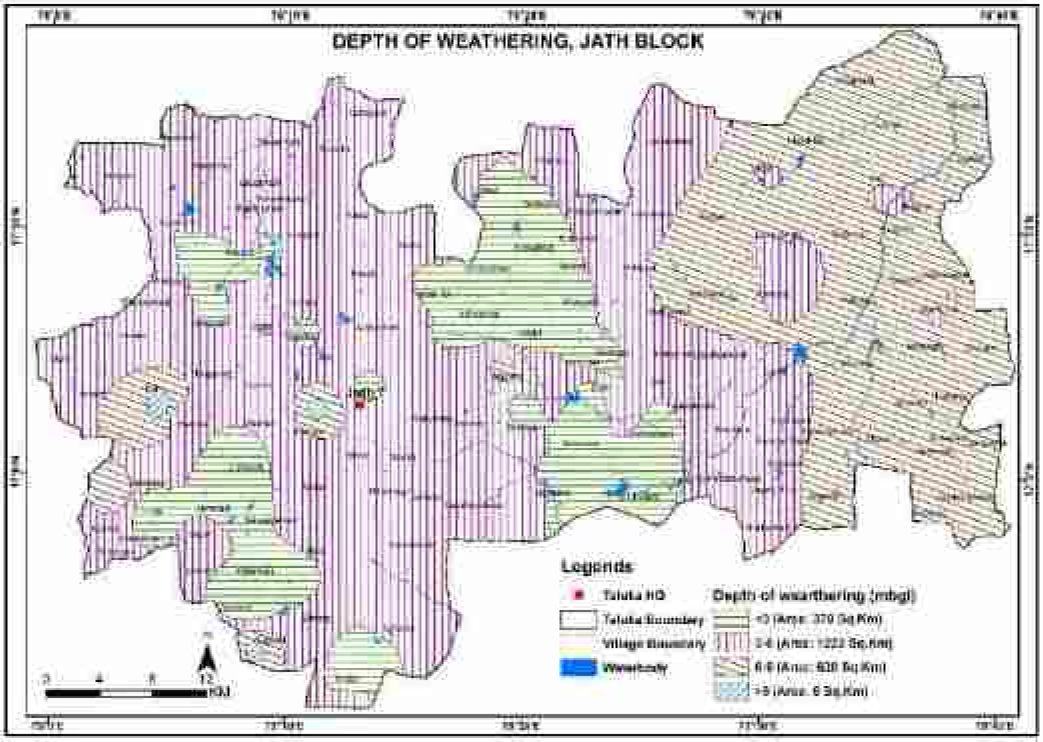



**Figure-4.6:** Depth of weathering, Jath Block.

On perusal of **Figure-4.6**, it is observed that depth of weathering varies from < 1 m to 12.7 meter below ground level (m bgl). Shallow weathering (less than 3 m) is observed in central and south-western part covering an area of 378 km². In major part of area, weathering is in the range of 3-6 m depth (1222 Km²) (55%), 6-9 m weathering is observed mostly in eastern part of area and in patches in central-western part covering 28% of area. Deep weathering (> 9 m) is observed in small patches covering an area of about 6 km² area.

**4.4.4 Deeper Aquifers (Aquifer-2)** Total, 229 bore wells having depth range of 33-315 m, were inventoried, details of well inventory carried out is given in **Annexure-2**. Based on deep drilling carried out by CGWB down to 200 m, it is found that majority of fractures occur in depth ranges of 50-100 m (34% of fractures). ~22% fractures occur within shallow depth of 30 m and 20% fractures occur below 150 m depth and deepest fracture is encountered at depth range of 193-196 m in south-western part of area (**Figure-4.7** & **Figure-4.8**).

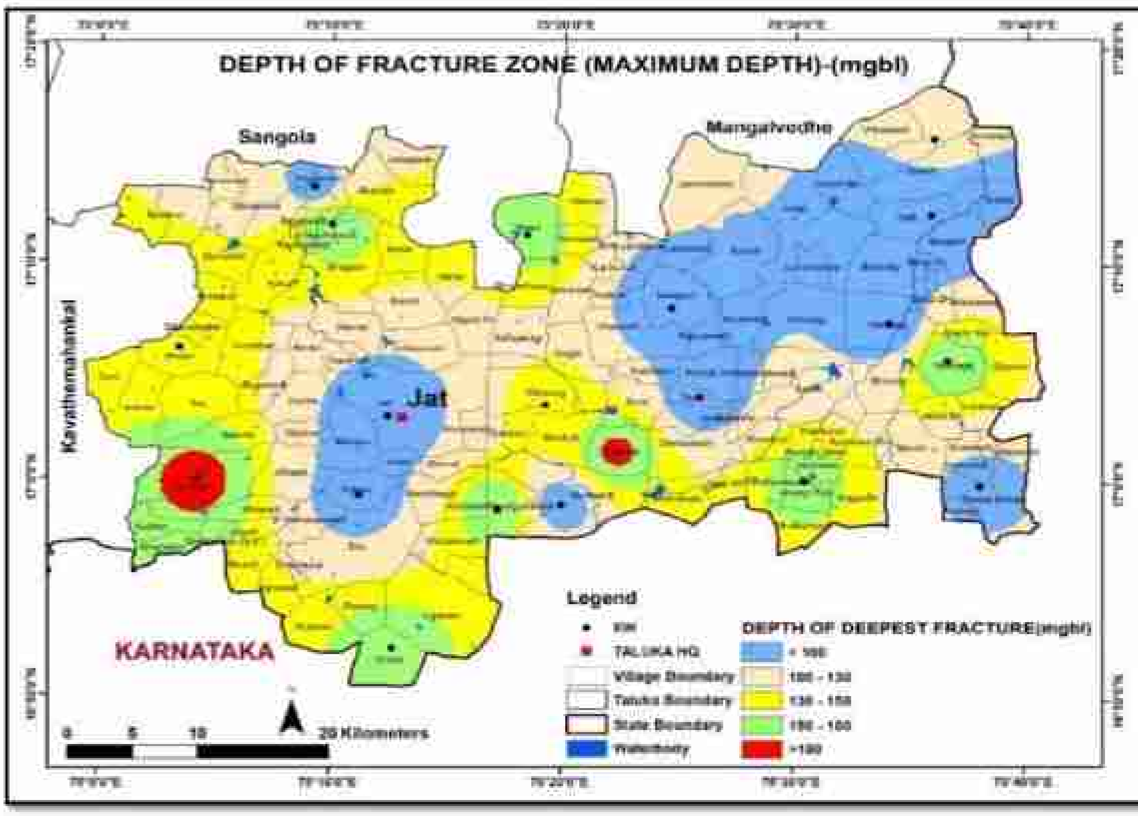



**Figure-4.7:** Depth of deepest fracture occurrence, Jath Block.

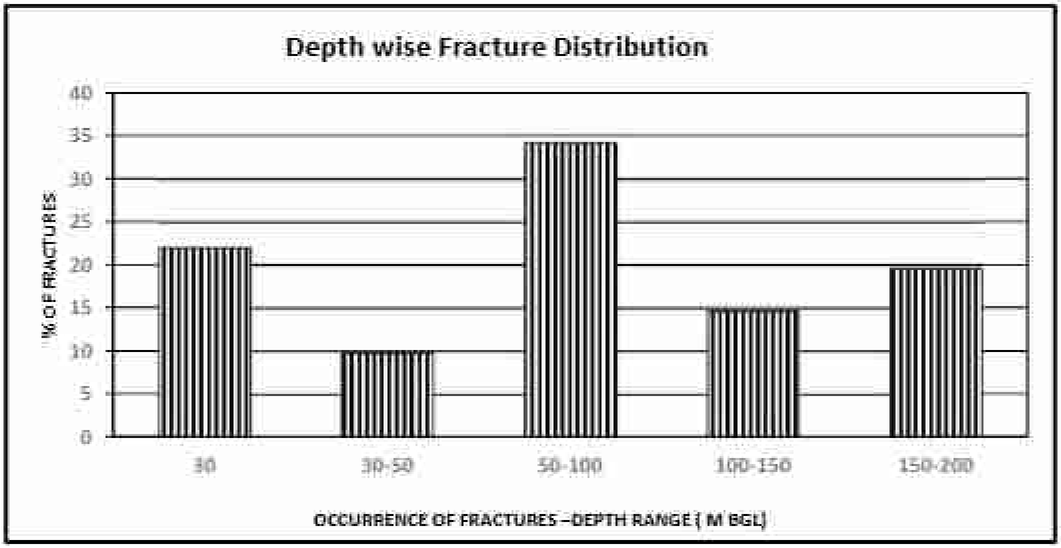



**Figure-4.8:** Depth wise fracture distribution, Jath Block.

### 4.4.5 Ground Water Occurrence and Yields:

Ground water occurs under confined conditions in shallow aquifer and in semi-confined to confined conditions in deeper aquifers in both seasons. During pre-monsoon season of 2023, ground water flows from central part to southern and northern part in central area and in north-east direction in eastern part of area. The hydrogeological map of area is presented in **Figure-4.9**. Higher yields (> 3 liter/second (lps)) are observed in eastern and north western part of block. From figure-4.9, it can be perused that high yielding wells are mostly controlled by drainage network and comparatively yields are high in discharge area of eastern part where Bor river, a tributary of Bhima River (tributary of river Krishna) flows and in central-western part. In about 990 Km2 area, yields are very low (< 1 lps).

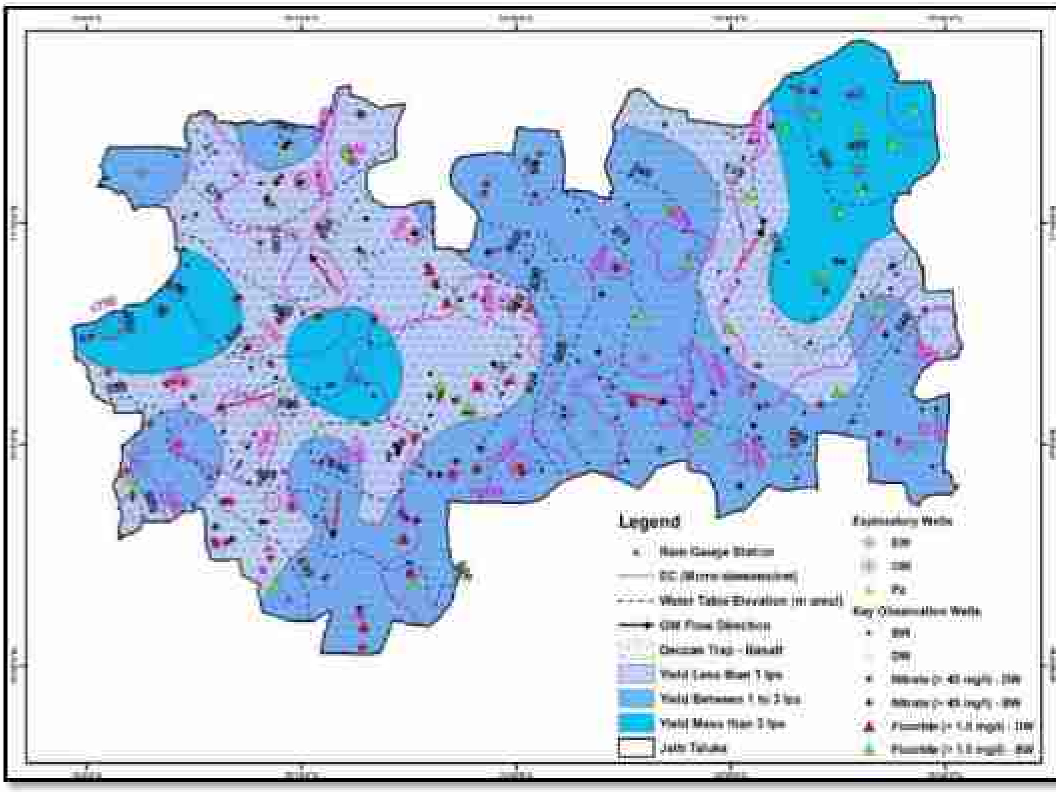



**Figure-4.9:** Hydrogeological Map, Jath Block.

### 4.4.6 Conceptualization of Aquifer through 3D

Conceptualization of 3-D hydrogeological model, fence diagrams and sections of the area are carried out by interpreting and integrating representative exploratory borewells drilled down to 200 m and from interpreted data from geophysical surveys. The lithological information was generated by using Rockwork software. The stacked profile from the lithology of exploratory wells is generated and presented in **Figure-4.10**. A 3-D lithological disposition model, fence diagrams and sections are presented in **Figure-4.11, 4.12 and 4.13a-c**.

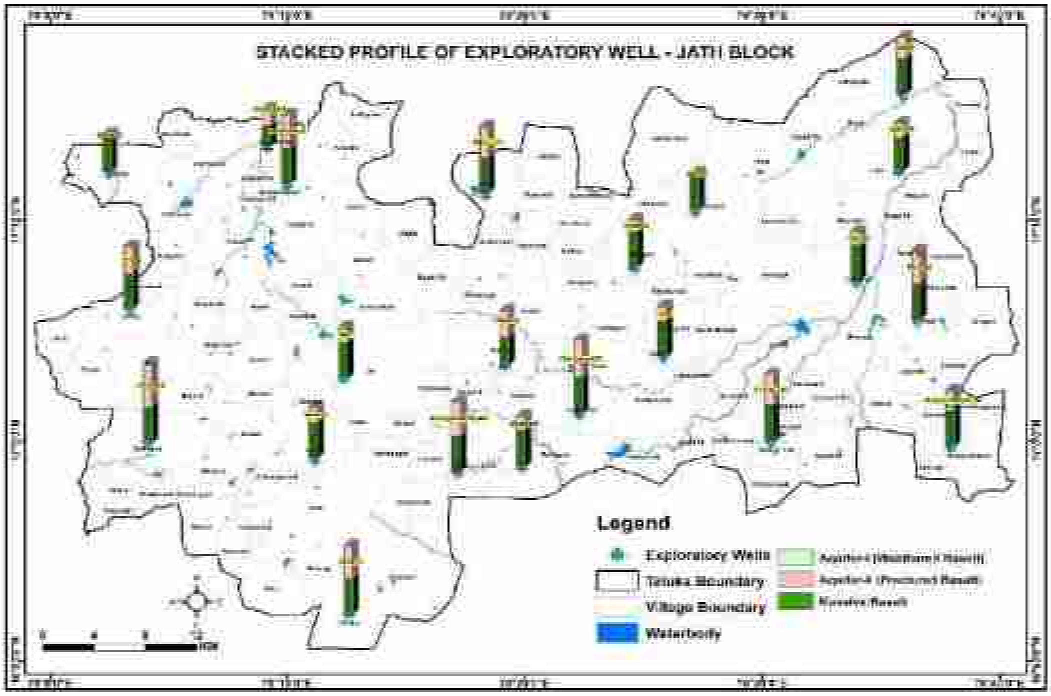



**Figure-4.10:** Stacked Profile of Exploratory wells, Jath Block.

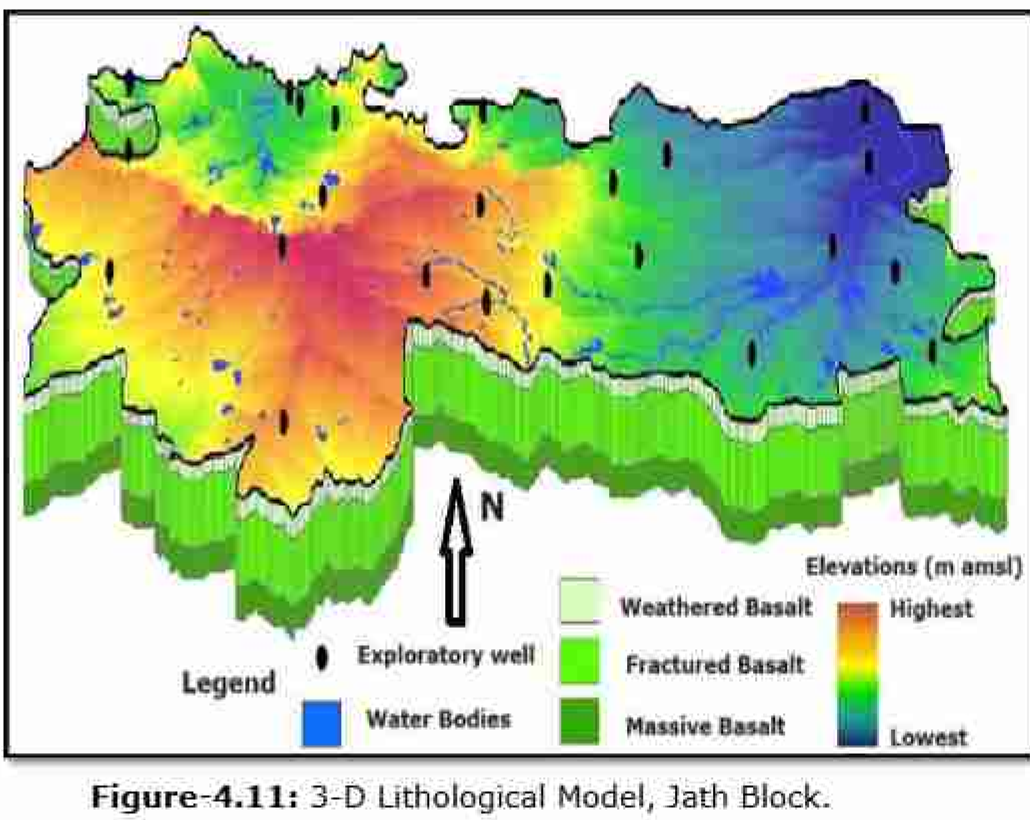



**Figure-4.11:** 3-D Lithological Model, Jath Block.

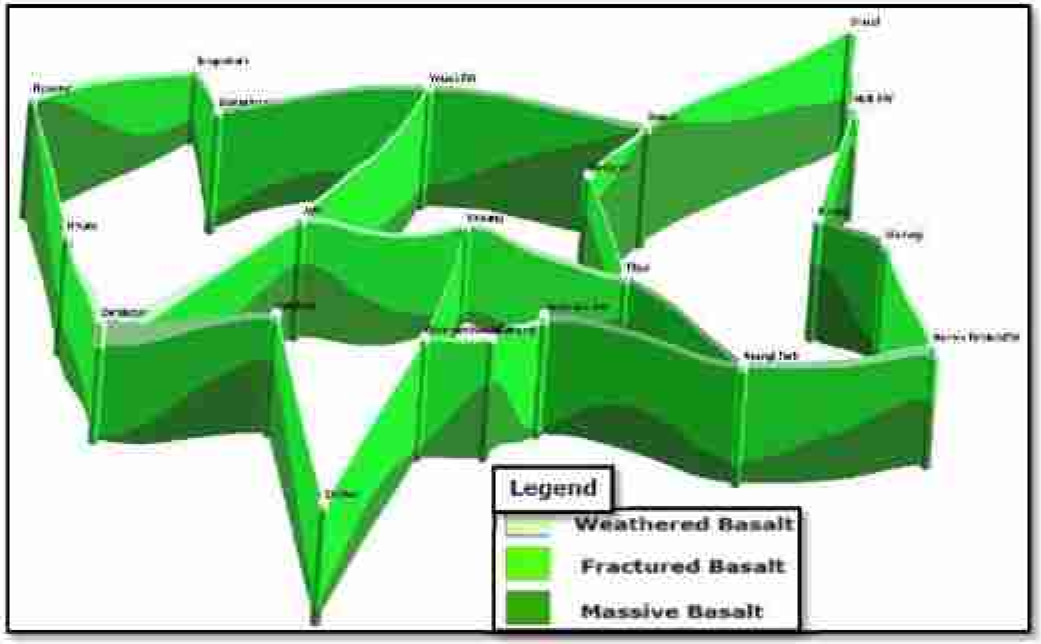



**Figure-4.12:** Fence Diagram, Jath Block**.**

A) **Hydrogeological section:** The section A-A' (**Figure-4.13a**) depicts a uniform weathered thickness in most parts except at locations near Hivare and Jath where thickness is more. The thickness of fractured zone shows decreasing pattern from east to west and again it gets thicker at Morbagi. The fractured thickness is more at locations like Hivare and Valsang. Discharge from exploratory well drilled at Jath and Hivare is high, which resonates with high weathered and fractured thickness.

B) **Hydrogeological section (S-N direction):** The section (**Figure-4.13b**) depicts almost uniform weathered thickness in most parts except at Dafalapur. The thickness of fractured zone is more at all locations except at Sonyal where fractured thickness is almost zero, which resonates with discharge of well as the well drilled is negligible. Massive rock thickness is high at Sonyal.

**C) Hydrogeological section (W-E direction):** The section (**Figure-4.13c**) depicts almost uniform weathered thickness in most part except at Kontev Boblad. The thickness of fractured zone is very high at Mokashiwadi, Yelavi and Asangi Turk.

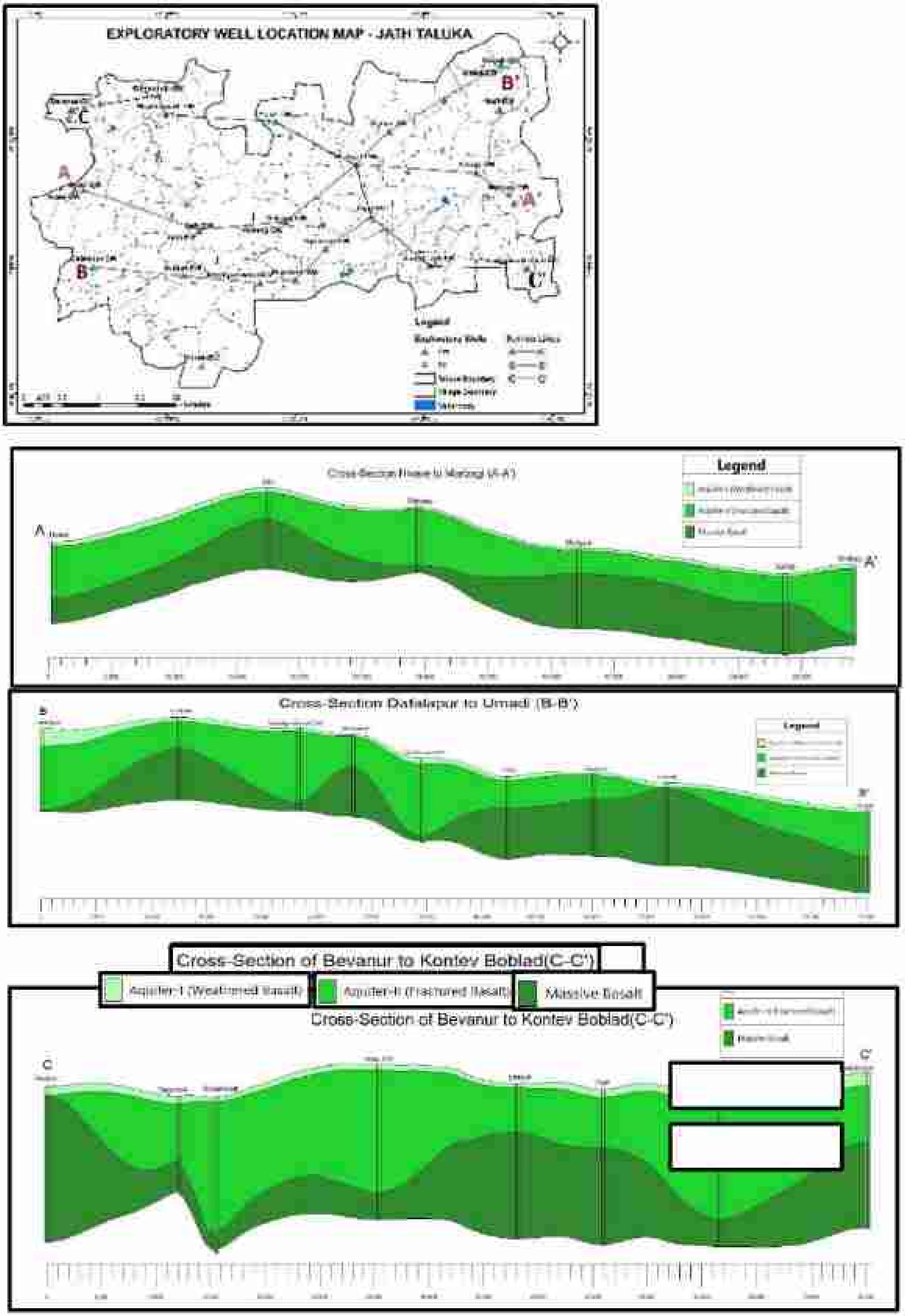



**Figure-4.12(a-c):** Lithological sections, Jath Block.

### 4.4.7 Aquifer Characteristics of Basalt

Ground water during pre-monsoon season of 2023, flows from central part to southern and northern part in central area and in north-east direction in eastern part of area (**Figure-4.9**). The ground water flow direction is towards western and north and south eastern side of block. Higher yields, >3 lps are observed in eastern and north western part of block.

For aquifer-I, the specific capacity of the wells tapping basalt ranges between 1.7 to 18.9 lpm/m of draw down. The transmissivity (T) varies from 2.6 to 36 $m^2$/day and storage coefficient (S) varies between $1.2 \times 10^{-4}$ to $6.52 \times 10^{-4}$ for aquifer-II.

# CHAPTER -5

# AQUIFER-WISE GROUND WATER LEVELS

## 5.1 Objectives:

Ground water level data is a critical component in understanding and managing ground water resources, offering valuable information about depth and variability of water table in an aquifer. Monitoring changes in ground water levels over a period of time provides insights into the health of aquifer system and this helps in making informed decisions about sustainable water use, especially in areas where ground water is a primary source of freshwater.

One key aspect of ground water level data is, its role in assessing aquifer recharge and depletion. By observing fluctuations in ground water levels, hydrologists can identify patterns related to natural recharge from precipitation and potential stressors leading to depletion, such as excessive pumping or prolonged droughts. This understanding is crucial for implementing effective ground water management strategies to maintain aquifer sustainability. Ground water level data is also instrumental in delineating ground water flow patterns. By analysing variations in water table elevations across different locations, hydrogeologists can map the direction and rate of ground water movement within an aquifer. This information aids in development of conceptual models for subsurface, contributing to more accurate predictions of ground water behaviour and facilitating sustainable water resource planning.

Furthermore, real-time ground water level data is essential for managing water infrastructure and mitigating potential risks. Monitoring wells equipped with sensors provide continuous updates on ground water levels, enabling rapid response to changing conditions. This is particularly valuable in preventing over-extraction, land subsidence, and other adverse impacts associated with improper ground water management.

## 5.2 Material and Methods:

Determining depth to water table or ground water levels in different aquifers involves a systematic study that incorporates following hydrological and geospatial techniques. Aquifer wise identification of key wells.

- Pre-Monsoon and Post monsoon water level Measurement.
- Data integration of existing from Ground Water Monitoring Wells (GWMW) and generated water level data from key wells.
- Depth to water level maps (pre and post monsoon).
- Hydrograph Analysis.
- Water table contour maps (for Aquifer I and Aquifer II).

## 5.3 Results and Discussion:

### 5.3.1 Water Table Elevations-Unconfined/Shallow Aquifer (Aquifer-1 (AQ-I))

In an un-confined aquifer, water table elevations during pre-monsoon season of 2023 (May month) varies from < 440 meter above mean sea level (m amsl) to > 780 m amsl (**Figure-5.1**). The ground water flows from central part to eastern part and from south-eastern to northern directions. In western part, it flows from central part to northern directions.

### 5.3.2 Depth to Water Levels- Shallow Aquifer (Aquifer-1 (AQ-I))

**Pre-monsoon Season (May,2023)**

Depth to water levels, during pre-monsoon season (May) of 2023 ranges between 1.08 m bgl (meter below ground level) to 25.5 m bgl (**Figure-5.2 and Annexure-I**). In the area, 5-10 m bgl, water levels are more predominant covering 65% of area. Shallow water levels (<5 m bgl) are observed in small patches in western, northern and central part. Deeper water level >10 m bgl mostly occurs in southern, south-eastern and in north eastern parts of Jath.

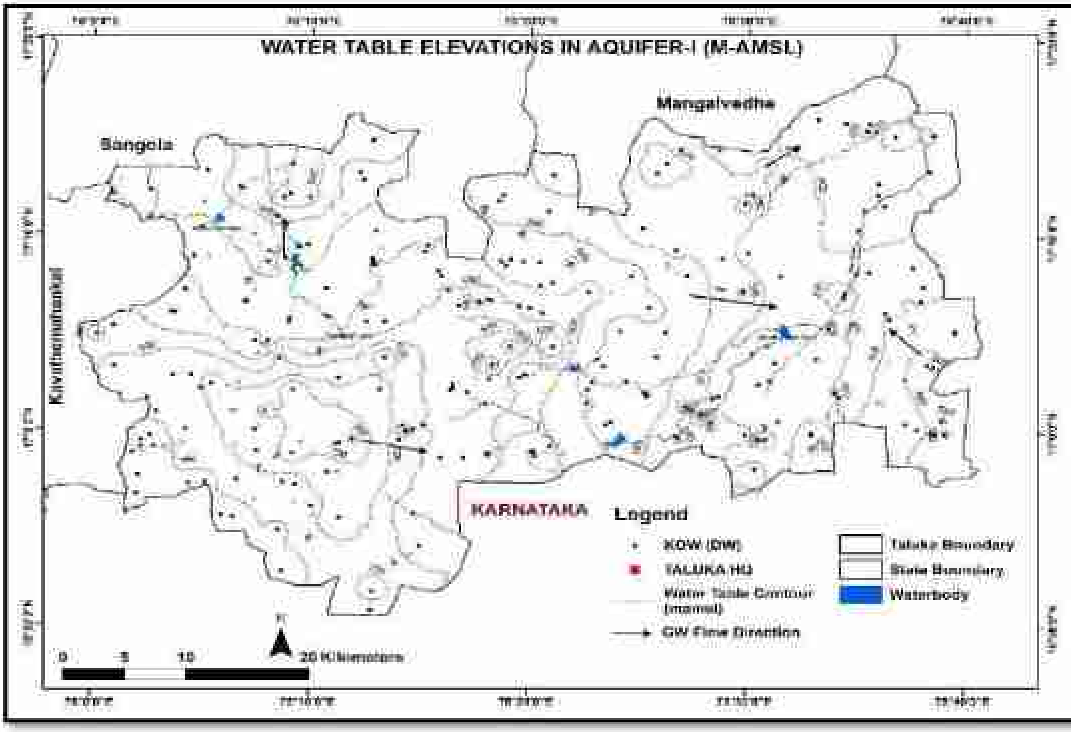



**Figure-5.1:** Water table elevations in AQ-I (m amsl), May-23.

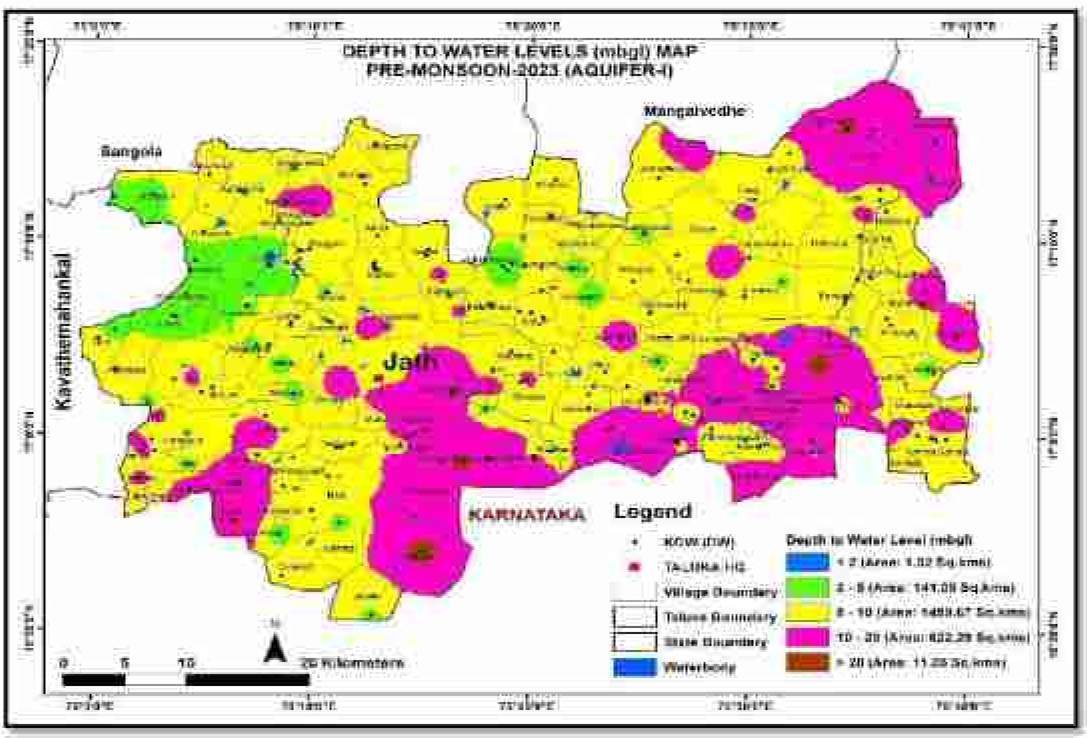



**Figure-5.2:** Depth to water levels in AQ-I (m bgl), May-23.

**Post-monsoon season (November,2023)**

Depth to water levels, during post-monsoon season (November) ranges between 0.75 to 25.5 m bgl (**Figure-5.3 and Annexure-I**). In the study area, 5-10 m bgl, water levels are more predominant covering 61% of an area. Shallow water levels (<5 m bgl) are observed in western part and deeper water levels, >10 m bgl occurs in patches, mostly covering eastern and north-eastern part.

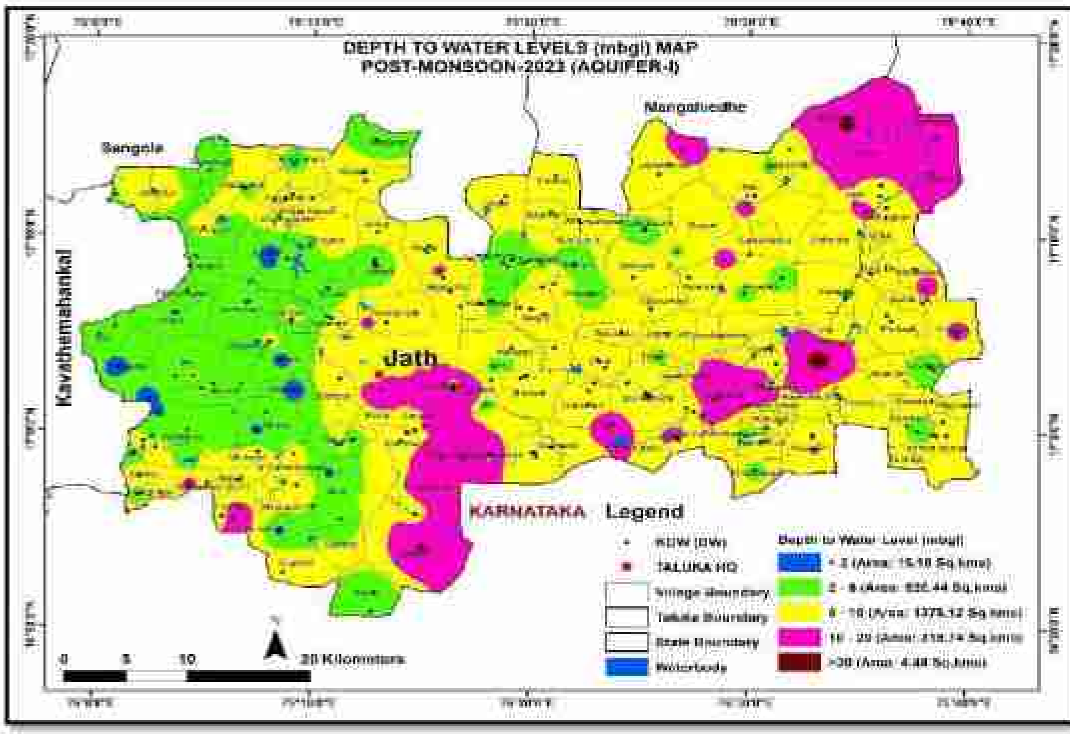



**Figure-5.3:** Depth to water levels in AQ-I (m bgl), Novemebr-23.

### 5.3.3 Water Table Elevations-Semi-confined/confined-Deeper Aquifer (Aquifer-2 (AQ-II))

In semi-confined/confined aquifer, water table elevations during pre-monsoon season of 2023 (May month) varies from < 390 to > 720 m amsl (**Figure-5.4 and Annexure-II**). The ground water flows from central part to eastern part and from south-eastern to northern directions. In western part, it flows from central part to northern directions.

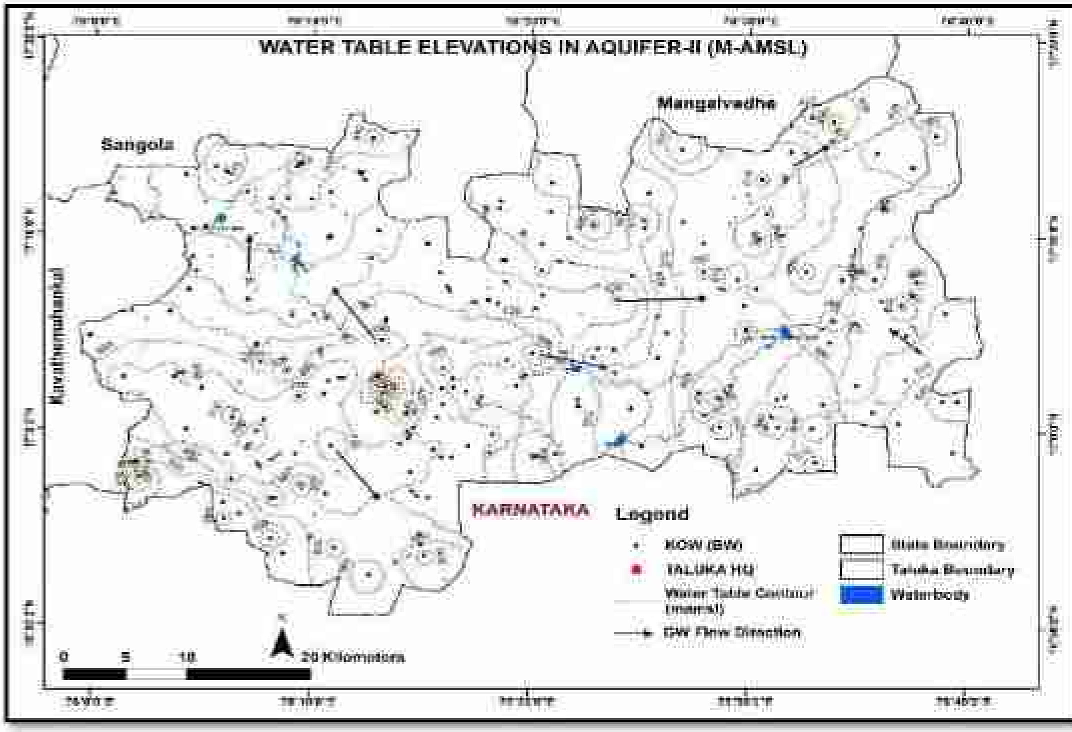



**Figure-5.4:** Water table elevations in AQ-II (m amsl), May-23.

### 5.3.4 Depth to water Levels-Semi-confined/confined Deeper Aquifer (Aquifer-2 (AQ-II))

#### Pre-monsoon Season (May-2023)

Depth to water levels, during pre-monsoon season, ranges between 1.78 to 112.4 m bgl (**Figure-5.5 and Annexure-II**). In study area, 20-40 m, water levels are more predominant, covering 47% of area. Very deep-water levels (> 40 m) are observed in 43% of area and shallow water levels (< 10 m) occurs in western part of area.

#### Post-monsoon season (November,2023)

Depth to water levels, during post-monsoon season, ranges between 1.5 to 102.5 m bgl (**Figure-5.6 and Annexure-2**). In study area, 20-40 m, water levels are more predominant covering 45% of an area. Very deep-water levels (> 40 m) are observed in 32% of area and shallow water levels in the range of 5-10 & < 10 m occur in western part of study area.

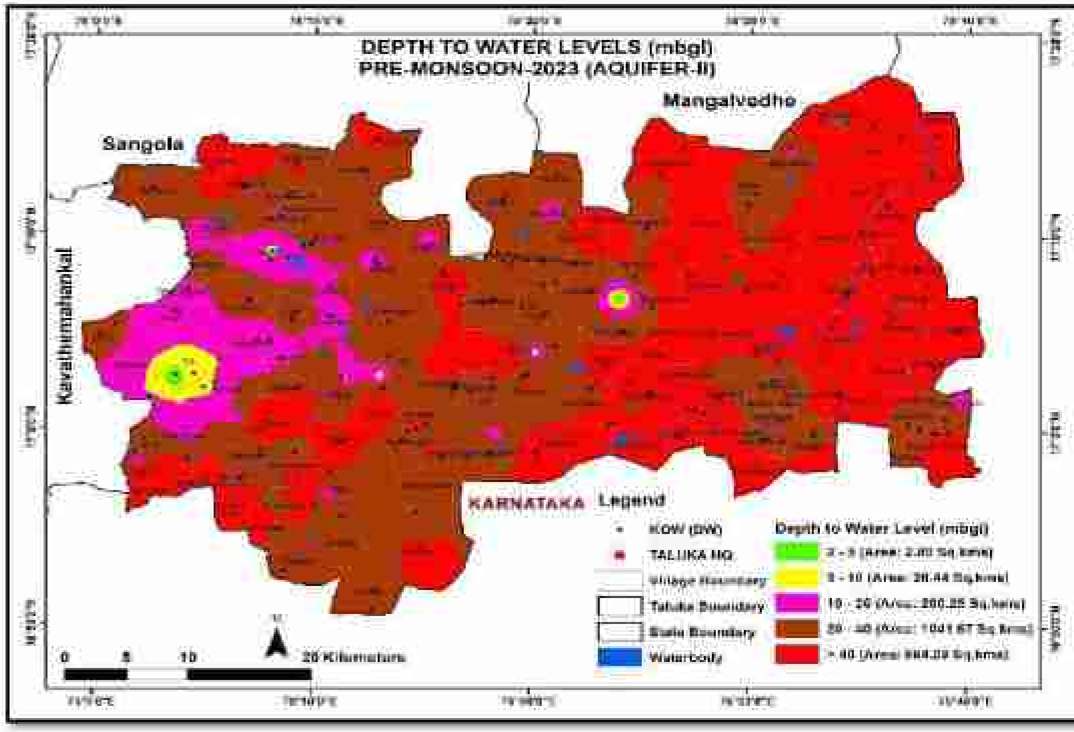



**Figure-5.5:** Depth to water levels in AQ-II (m bgl), May,23.

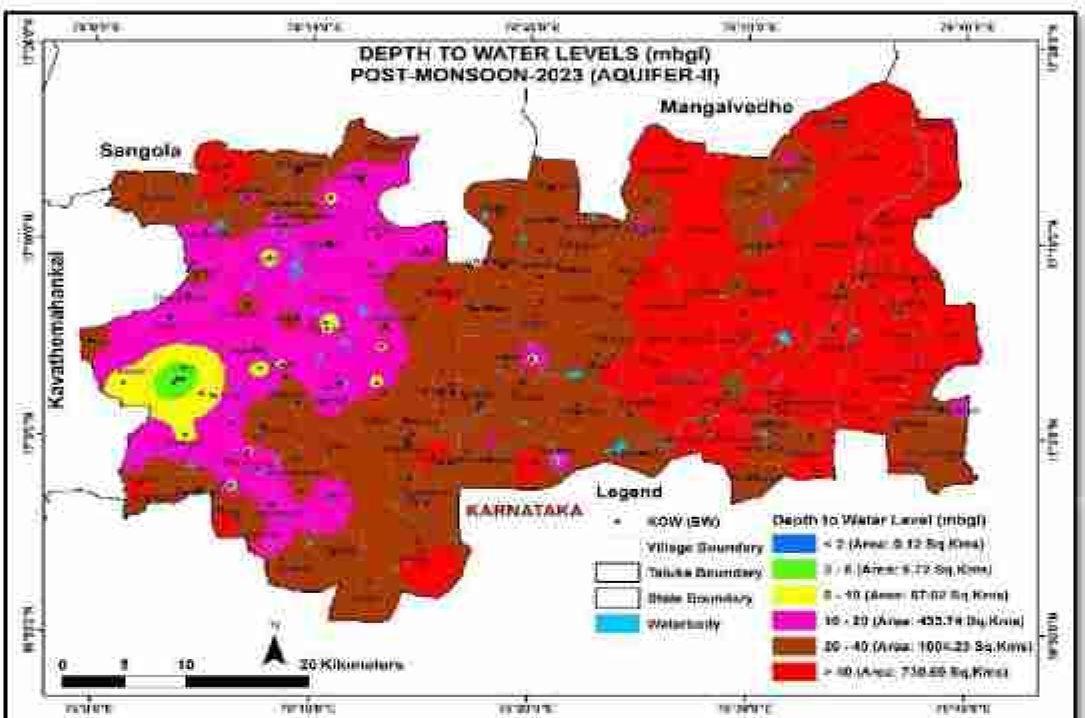



**Figure-5.6:** Depth to water levels in AQ-II (m bgl), November,23.

### 5.3.5 Water Level Fluctuations (WLF):

Fluctuation of water levels in an area are due to variations in recharge and discharge components in groundwater regime. Recharge components are precipitation, water applied for irrigation and percolation from surface water bodies. Discharge is mainly due to withdrawal of ground water for irrigation, domestic and industrial uses, effluent seepage into drainage courses & evapotranspiration. Fluctuation is also affected by topographic configuration and geological setup of in an area. Seasonal changes are observed because of monsoon rainfall received over an area.

Fluctuations of water levels during post-monsoon season with respect to pre-monsoon season for both shallow and deeper aquifers for the year 2023 is presented on **Figure-5.7 and Figure-5.8** respectively and data is classified into two categories i.e., rise or fall.

**Shallow Aquifer:**

During post-monsoon season in shallow aquifers, in most of area water levels have shown a rise (0 to > 6 m) (**Figure-5.7).** Rise in the range of 0-2 m is observed in 57% of area and the maximum rise (>6 m) is observed in south-western part and south-eastern part. In very minor area (5 $km^2$), water levels have shown a fall (up to 6 m).

**Deeper Aquifer:**

During post-monsoon season in deeper aquifers, in major part of area, water levels have hown a rise (0 to > 6 m) (**Figure-5.8).** Rise in the range of 2-4 m is observed in 35.5 % of area and the maximum rise (>6 m) is observed in south-western part and south-central part. In 129 $km^2$ area only fall up to 6 m is observed (in south-eastern part and southern part).

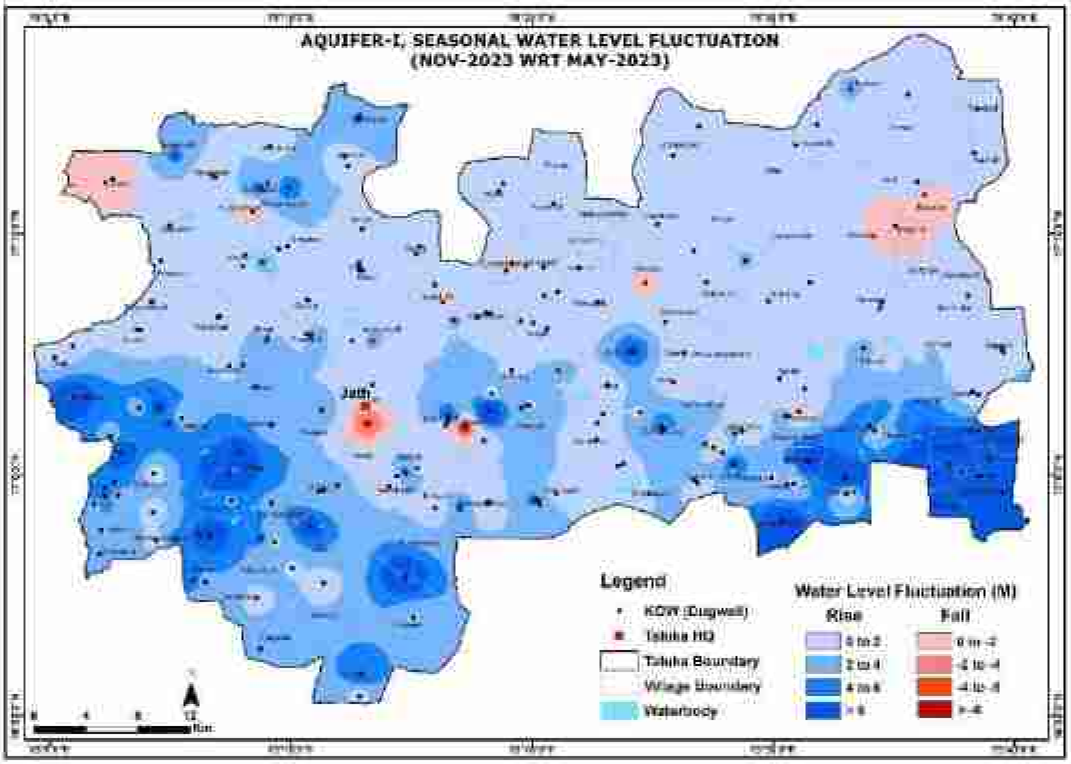



**Figure-5.7:** WLF during post WRT Pre-monsoon season (Shallow Aq.).

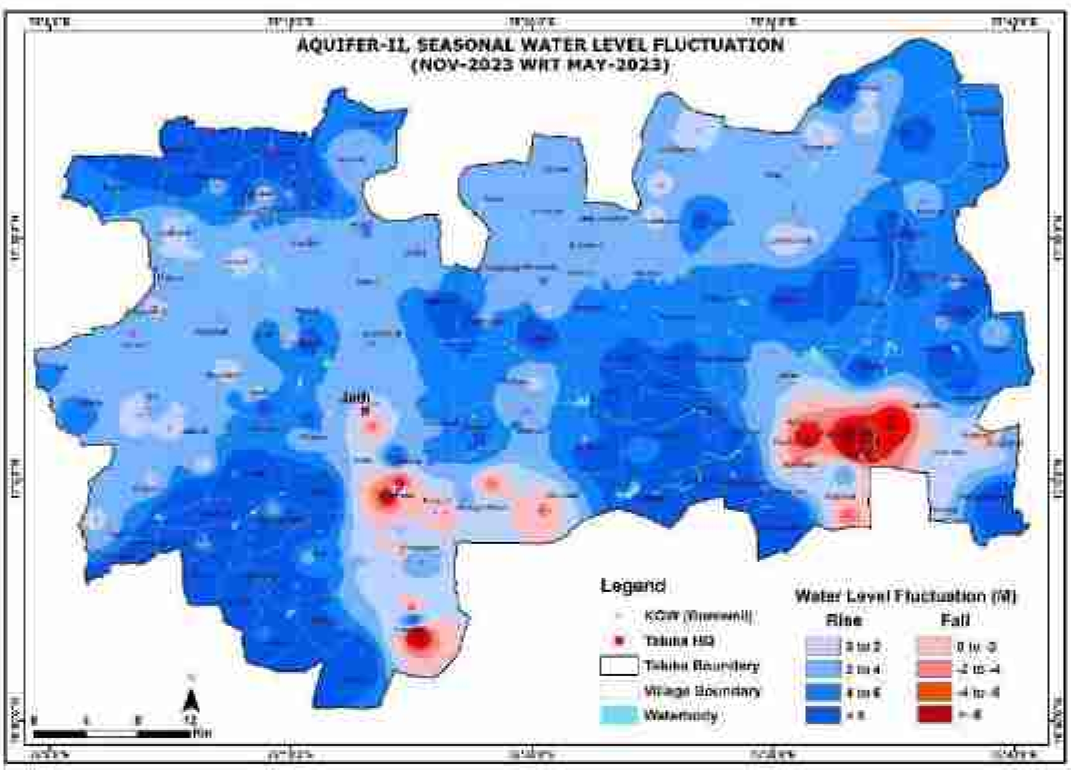



**Figure-5.8:** WLF during post WRT Pre-monsoon season (Deeper Aq.).

### 5.3.6 Water Level Trends

Trend analysis for the last 10 years (2014-2023) is studied from 25 hydrograph stations of CGWB and GSDA. During pre-monsoon season, it is observed that in 20 wells rising trends (@0.03-0.91 m/yr) are observed and in 5 wells, falling trends are observed (3 wells @ 0-0.1 m/yr; 1 well @ 0.1-0.2 m/yr and 1 well @ >0.2 m) (max fall: 0.26 m/yr) (**Figure-5.9)**. During post-monsoon season, in 16 wells rising trends are observed (@0.0-0.8 m/yr) and in 9 wells, falling trends @0-0.1 m/yr to 0.27 m/yr are observed (**Figure-5.10)**. The fall is mostly observed in eastern and north-western part in both seasons.

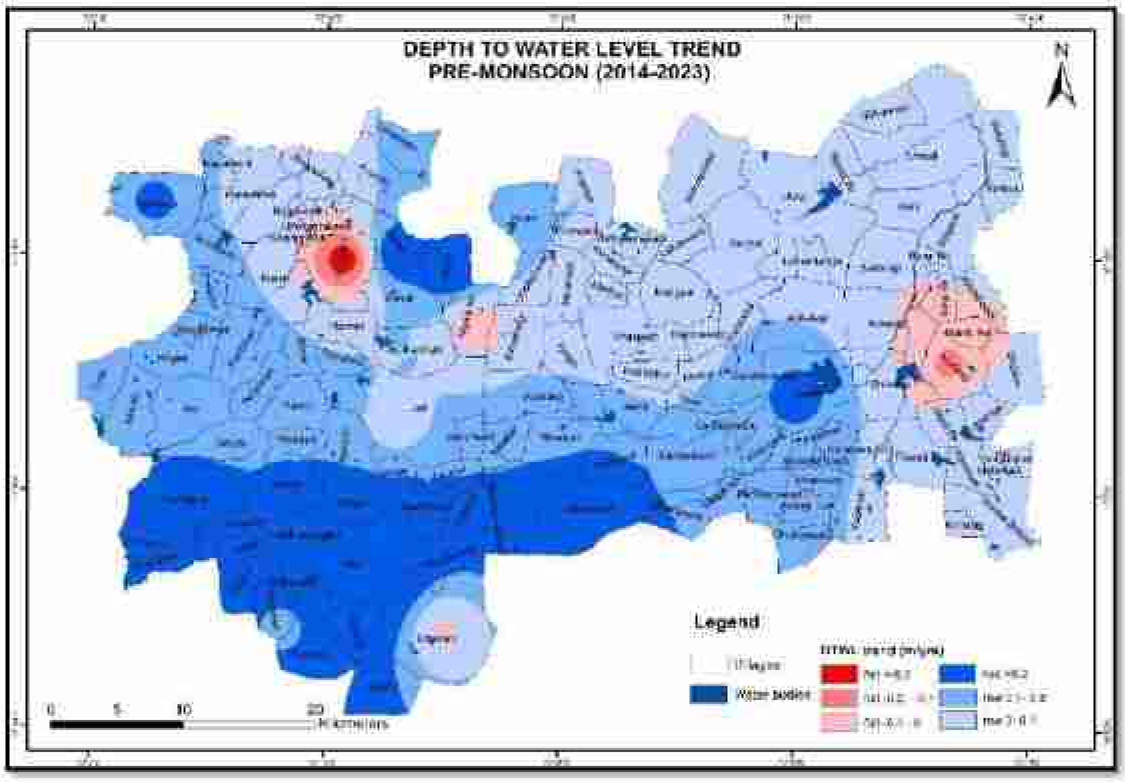



**Figure 5.9:** Water level trends, pre-monsoon season.

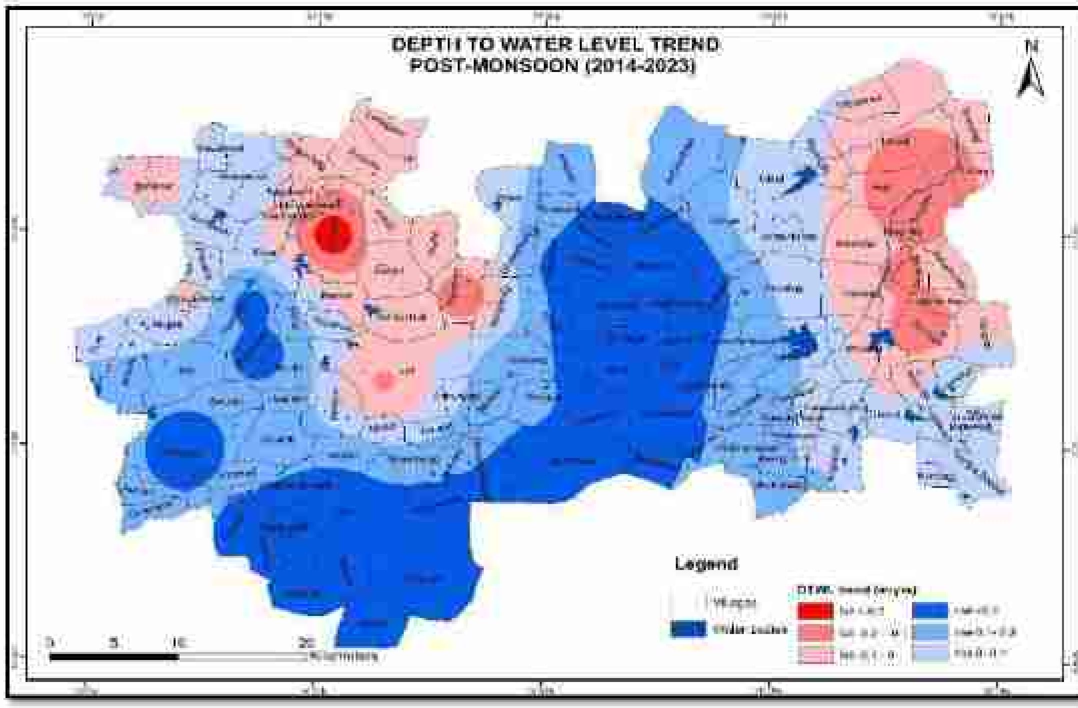



**Figure 5.10:** Water level trends, post-monsoon season.

### 5.3.7 Hydrograph Analysis

Variation in short and long-term water level trends, is due to variations in natural recharge, rainfall and withdrawal for various uses and for these 5 hydrograph stations are studied in detail (**Figure-5.11a-e**). Rising limb, shows a natural recharge due to monsoon rainfall and recession limb, indicates continuous increase in extraction. Out of 5 hydrographs, 4 shows rising trends in both seasons (pre-monsoon @0.06-0.91 m/yr & post-monsoon 0.09-0.28 m/yr) and only one (Shegaon), shows failing trend in both seasons i.e., @0.25m/yr during pre and @0.26 m/yr during post monsoon season.

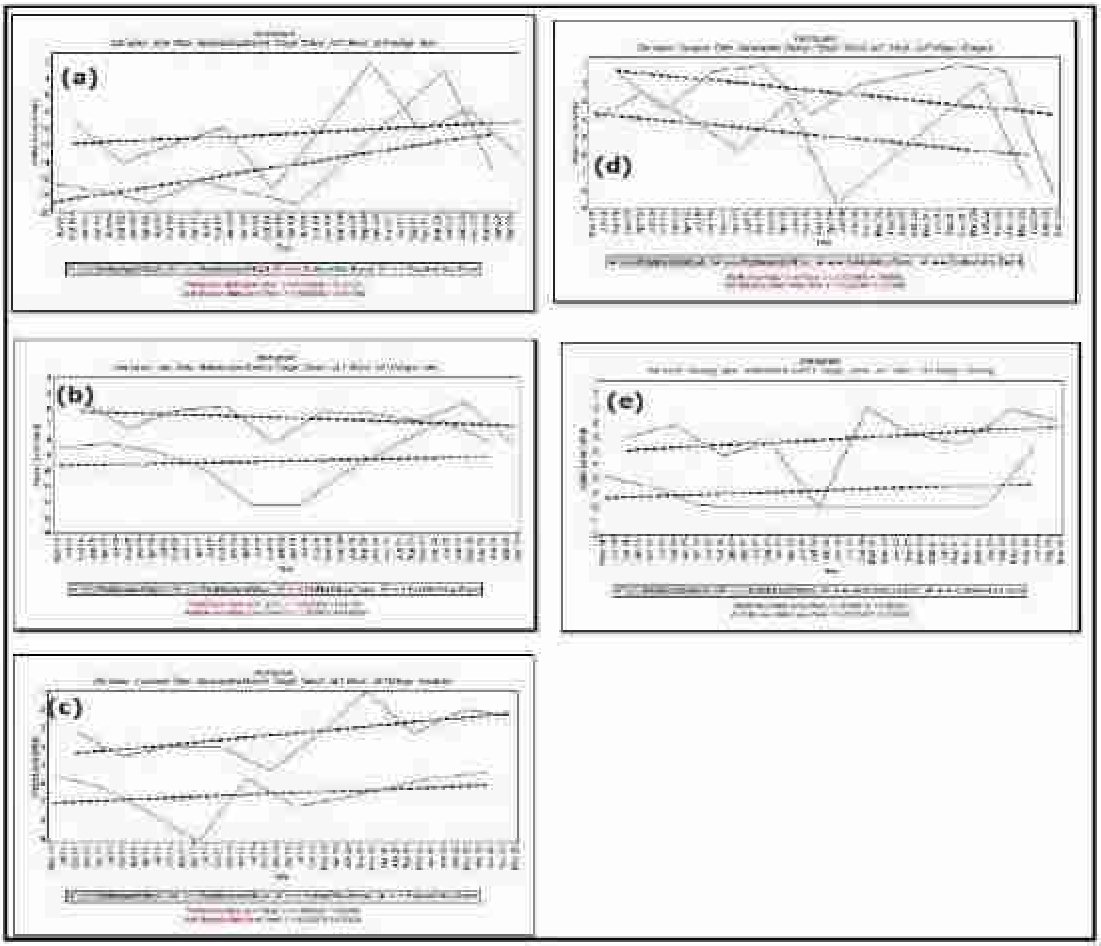



**Figure 5.11 (a-e):** Representative Hydrographs.

# CHAPTER -6

# DELINEATION OF RECHARGE AREAS

## 6.1 Objectives:

Ground water movement within a ground water basin, typically initiates from recharge areas and progresses towards discharge area. The recharge area constitutes a vital segment of watershed, where ground water diverges in all directions. This region is characterized by a vertically downward flow of ground water, signifying the direction in which water traverses through the geological formations.

In the recharge area, the water surface saturates through topsoil to reach water table, marking a crucial process in replenishment of ground water resources. This infiltration mechanism plays a pivotal role in sustaining aquifer by allowing water to seep through various layers of soil and rock, contributing to overall health of ground water basin.

Furthermore, characteristics of recharge area encompass a deep phreatic water level, typically situated below the piezometric surface in normal conditions. This configuration highlights depth at which ground water is present and emphasizes the significance in understanding vertical distribution of water within the aquifer. The interplay between phreatic water level and piezometric surface provides valuable insights into the dynamics of ground water flow in this region.

Another distinctive feature of recharge area is relatively low concentration of chemical constituents in ground water. This aspect is crucial for assessing quality of replenishing water and its potential impact on the overall ground water composition. The lower chemical load in this area contributes to the maintenance of water quality as it percolates through the soil, preserving integrity of an aquifer.

Lastly, recharge area is characterized by ground water with a younger age compared to other parts of ground water basin. Age of ground water refers to time elapsed since it entered into an aquifer. In the recharge area, relatively younger age of ground water, indicates a more recent influx, reflecting ongoing process of replenishment and emphasizing the dynamic nature of ground water flow within the basin.

## 6.2 Material and Methods:

In order to delineate recharge worthy area in taluka, digital elevation model (DEM) data along with lithological data from existing & drilled wells along with data collected from key wells, feedback from farmers etc is analysed. These data are entered in the prescribed format for generating depth to water level maps, depth of weathering and identifying feasible areas for recharge.

## 6.3 Results and Discussion:

### 6.3.1 Storage Potential of Unsaturated Aquifer

The volume of water for recharging the unsaturated zone (dry) of phreatic aquifers is estimated by multiplying the area with the available unsaturated thickness having water levels below 3 meters below ground level (m bgl) during post-monsoon season is considered along with specific yield. Thus, the total storage potential of phreatic unsaturated aquifer is estimated at 10176 million cubic meters (mcm). In the area based on normal rainfall and non-commuted runoff, 17.03 mcm of surplus surface water is available and can be utilized. The area suitable for recharge is given in **Figure-6.1.**

From the **Figure-6.1**, it is seen that the most of the recharge worthy area lies eastern and southern part of taluka, where suitable artificial recharge structures can be proposed. The Village wise management plan is discussed in detail in ground water management chapter.

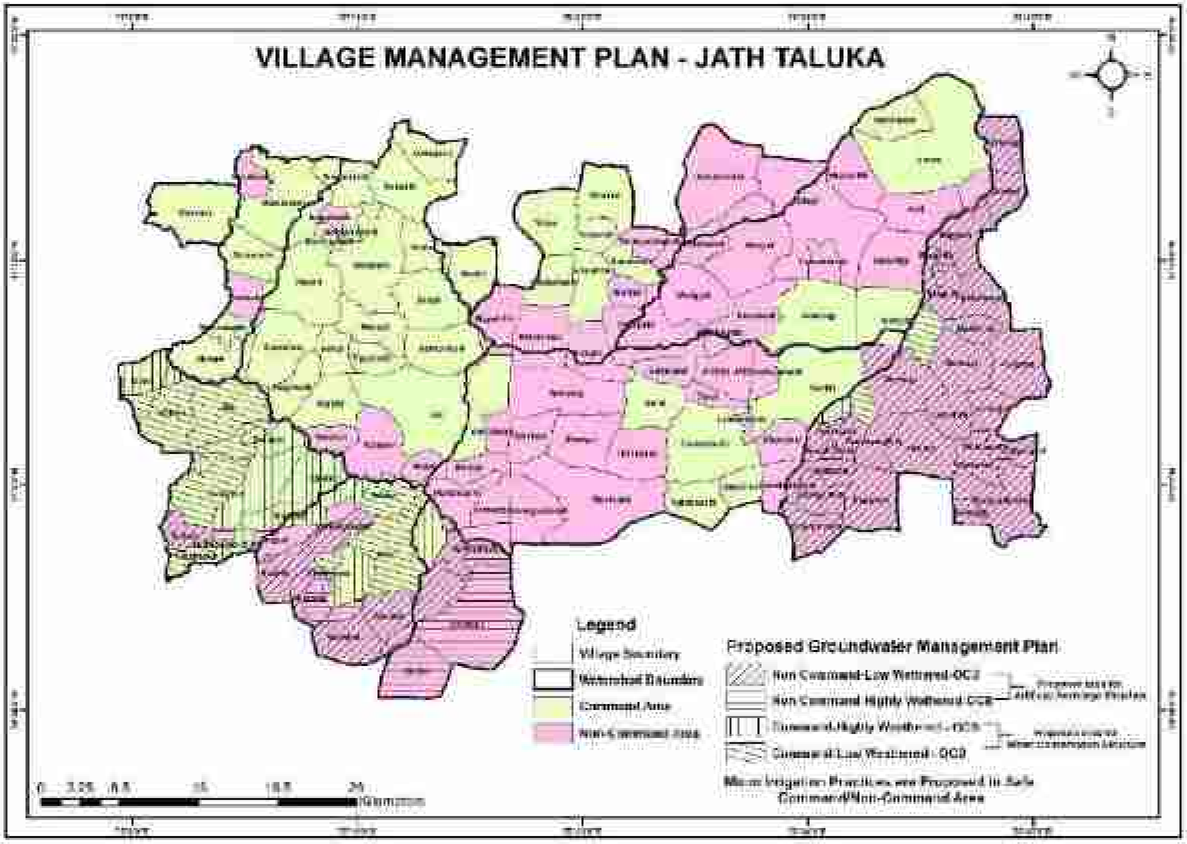



**Figure-6.1:** Area suitable for various ARS & WC structures.

# CHAPTER -7

# GROUND WATER-RESOURCES & REFINEMENT OF PARAMETERS

## 7.1 Objectives:

The National Water Policy (2012), formulated by Ministry of water Resources, Govt of India, stresses for periodic reassessment of groundwater resources on scientific basis, taking into consideration the quality of water available and economic viability of its extraction.

The quantitative estimation of various inputs to ground water resources and their temporal variation in space and time is imperative for a planned management and development of ground water resources. The resources are computed based on methodology recommended by the Ground Water Estimation Committee report (GEC-2015), of Ministry of Water Resources, Govt. of India.

The prime objective of this chapter is refinement of parameters and lithology wise ground water resource estimation.

## 7.2 Material and Methods:

The assessment of ground water resources for Maharashtra State has been carried out by Groundwater Survey and Development Agency (GSDA) in collaboration with Central Ground Water Board (CGWB) under the guidance of State Level Committee (SLC) as per the revised GEC-2015 Methodology. As the GEC-2015 methodology is the standard procedure for computation of ground water resources, therefore, it is not discussed in detail.

## 7.3 Results and Discussion:

The result of ground water resources assessment-2023 for Jath block, Sangli district are given in **Table-7.1**.

**Table-7.1:** Dynamic Ground Water Resources Estimation (2023), Jath block.

| S. No. | Particulars | | in Ham |
|---|---|---|---|
| 1 | Recharge worthy area (hector) | : | 224761 |
| 2 | Recharge from Rainfall (Monsoon) | : | 15242.15 |
| 3 | Recharge from other sources (Monsoon) | : | 3048.53 |
| 4 | Recharge from Rainfall (Non-monsoon) | : | 121.76 |
| 5 | Recharge from other sources (non-monsoon) | : | 8934.53 |
| 6 | Total Annual GW Recharge | : | 27346.47 |
| 7 | Net annual natural discharge | : | 1475.74 |
| 8 | Annual extractable GW Resources | : | 25870.72 |
| 9 | GW used for irrigation (irrigation draft) | : | 15822.5 |
| 10 | GW used for domestic (domestic draft) | : | 691.7 |
| 11 | GW used for Industries (Industrial draft) | : | 0 |
| 12 | Total GW Extraction for all uses | : | 16514.3 |
| 13 | GW allocation for domestic use (as on 2025) | : | 691.7 |
| 14 | Net GW available for future irrigation use | : | 9576.4 |
| 15 | Stage of GW extraction | : | 63.8 |
| 16 | Category of Block | : | Safe |

### 7.3.1 Refinement of Parameters

**Soil Infiltration Tests**

In order to refine the rainfall infiltration factor considered for estimating ground water resources, 8 (eight) number of soil infiltration test were carried during January and February months of 2023 at 8 different locations (**Figure-7.1 & Figure-7.2)**. These tests were conducted at different locations covering different soils by using standard double ring infiltrometer with constant head method (**Table-7.2**). Attempt has been made to spatially cover the entire area covering all types of soils and land use.

**Figure-7.1:** Soil Infiltration test in field.

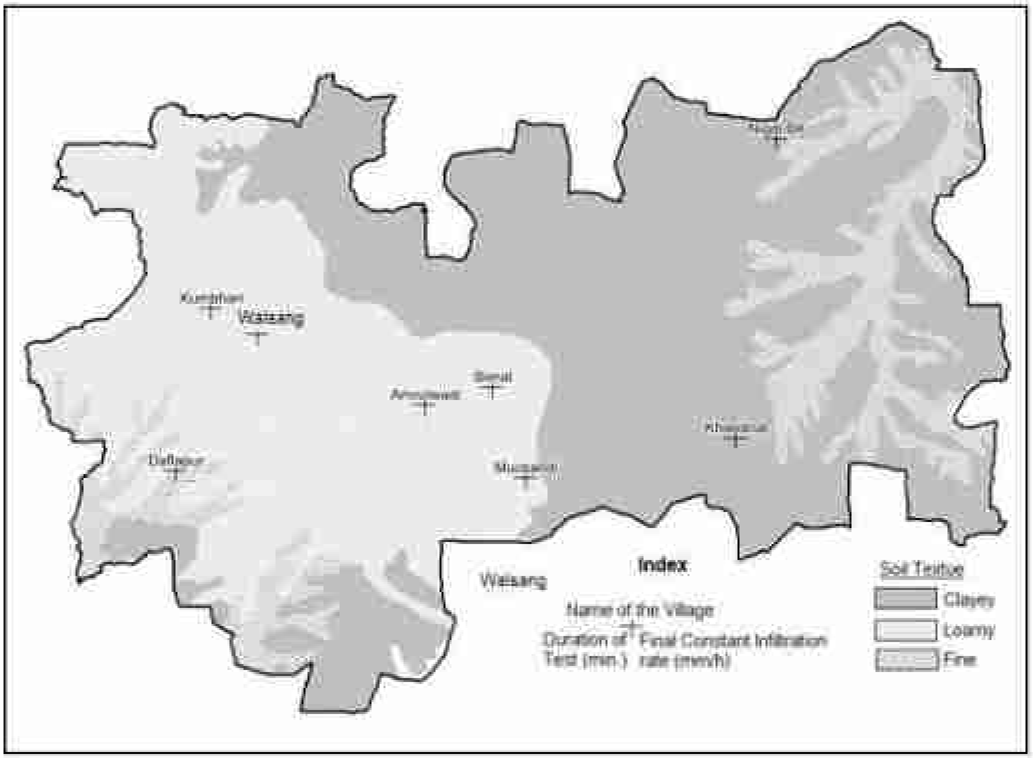



**Figure-7.2:** Locations of soil infiltration test.

**Table-7.2:** Location of infiltration test sites.

| S. No. | Village | Lat | Long | Soil Type | Land Use | Infiltration Rate (cm/hr) | Rainfall Coefficient/(%) |
|---|---|---|---|---|---|---|---|
| 1 | Birnal | 17.0963 | 75.1507 | Loamy | Agr. | 1.2 | 0.21/ (21) |
| 2 | Kumbhari | 17.1133 | 75.1183 | Loamy | Agr. | 3 | 0.20/ (20) |
| 3 | Amruthwadi | 17.0492 | 75.2684 | Loamy | Agr. | 4.8 | 0.13/ (13) |
| 4 | Walsang | 17.0605 | 75.3157 | Loamy | Agr. | 4.8 | 0.13/ (13) |
| 5 | Khandnal | 17.0266 | 75.4868 | Clayey | Barren | 3.6 | 0.04/ (4) |
| 6 | Nigadi BK | 17.2272 | 75.5154 | Clayey | Barren | 4.8 | 0.03/ (3) |
| 7 | Muchandi | 17.0001 | 75.3394 | Loamy | Barren | 4.8 | 0.03/ (3) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 8 | Dafalapur | 17.0049 | 75.0934 | Fine | Barren | 6 | 0.09/ (9) |
| | **Average** | | | | | | **0.1075** **(10.75 %)** |

The rainfall coefficient has been calculated by using the Horton's infiltration equation as under

$$fp = fc + (fo-fc)e^{-kt}$$

Where:

fp = Infiltration capacity at any time t

fc=Final steady state infiltration capacity

fo = Initial infiltration capacity

k = Horton decay constant

Since the infiltration coefficient is inversely related to the Horton decay constant, the rainfall coefficient has been calculated after getting the value of Horton decay constant from the above equation with the help of time Vs ln(fp-fc) graph.

The above method is very simplified and may not capture other factor fully like soil property, antecedent soil moisture, rainfall intensity and duration, slope, vegetation cover etc.

However, based on the above exercise it can be inferred that in agricultural land/ (or disturbed land) the infiltration coefficient (K) varies between 0.13 to 0.21, whereas in barren land, it ranges from 0.03 to 0.09 with average of 0.1075 (i.e., 10.75 %).

In Maharashtra State, the ground water resources have been estimated by taking the watershed as an assessment unit. The calculated ground water resources are finally allocated to blocks falling in the concerned watershed. Collectively for the Jath block, while computing resources of 2023, 0.11 infiltration factor (11%) is considered for both command and non-command area.

The average value of infiltration coefficient (0.1075) obtained from soil infiltration tests is very close to infiltration factor taken/used (0.11) in GEC methodology, hence, no comparison has been attempted for the already calculated ground water resources. Therefore, from the above exercise no refinement in infiltration factor has been suggested. However, if the assessment unit is further divided to calculate rainfall recharge based on the soil type and/or land use, the above data may be used for further refinement.

# CHAPTER -8

## GROUND WATER QUALITY

### 8.1 Objectives:

In any hydrogeological studies, evaluation of quality of ground water is as important as its quantity, as the usability of resources available are determined by their chemical, physical and bacteriological properties (Karanth, 1987). The reliability of any hydrochemical data depends upon collection of representative samples, sampling method, storage of samples and selection of proper analytical technique for chemical analysis (Cook and Miles, 1991).

Regular monitoring and assessment help in identifying and addressing potential hazards, ensuring that water treatment facilities can effectively remove or mitigate these contaminants, thus providing safe and clean drinking water to people. In agriculture, water quality assessment is crucial for its suitability for irrigation. Poor water quality can have detrimental effects on soil health and crop productivity. Presence of high levels of salts, sediments, or toxic substances in applied ground water can lead to soil degradation, affecting its fertility and structure. By providing ground water quality data on its suitability, farmers can make informed decisions about irrigation practices, selecting appropriate water sources and optimizing resource utilization to enhance agricultural productivity while minimizing environmental impacts. Bacteriological testing of ground water samples is not carried out, because it is beyond the scope of present work.

### 8.2 Material and Methods:

In present work, standard methods prescribed by American Public Health Association (APHA, 2023, Revised Edition) are followed for field and laboratory analysis of Ground water samples. The samples were analysed for pH, Electrical Conductivity (EC), total hardness (TH), major cat ions i.e.,

$Ca^{2+}$, $Mg^{2+}$, $Na^{+}$, $K^{+}$, and major an ions namely, $CO_3^{2}$, $HCO_3$, $Cl^-$ $SO_4^{2-}$, $NO_3^-$ and $F^-$. Based on major ion chemistry, various plots such as Piper and USSL diagram were generated using AquaChem software.

For analysis of heavy metals, samples were acidified in field and tested for their presence in laboratory immediately after transferring them. Reproducibility of the analytical technique is checked by replicate analysis of one particular sample in a batch of every ten samples. Some of the analytical results are also cross checked by using different methods.

Laboratory data is then evaluated by calculating the measured concentrations in mg/L to an electrical equivalent unit for each major ion (APHA, 2023). Cation/anion balance is then calculated by comparing the sum of the equivalents due to cations with sum of equivalents due to anions. A reasonable balance for cation/anion is generally considered to be ± 5 % (Deutsch, 1997) and in presence analysis it is within permissible limits.

During pre-monsoon season (May) of 2023, and post-monsoon season (November) of 2023, total 424 samples and 242 samples were collected from established key observation wells (KOW) (Aquifer-1:201 and Aquifer-2: 223) and (Aquifer-1:76 and Aquifer-2: 166) respectively. Location of samples are plotted on **Figure-8.1 to 8.4** and tabulated in **Annexure-III & IV.** In order to know presence of heavy metals in Ground water from the area, 67 samples were collected during pre-monsoon season of 2023 (**Figure-8.5).**

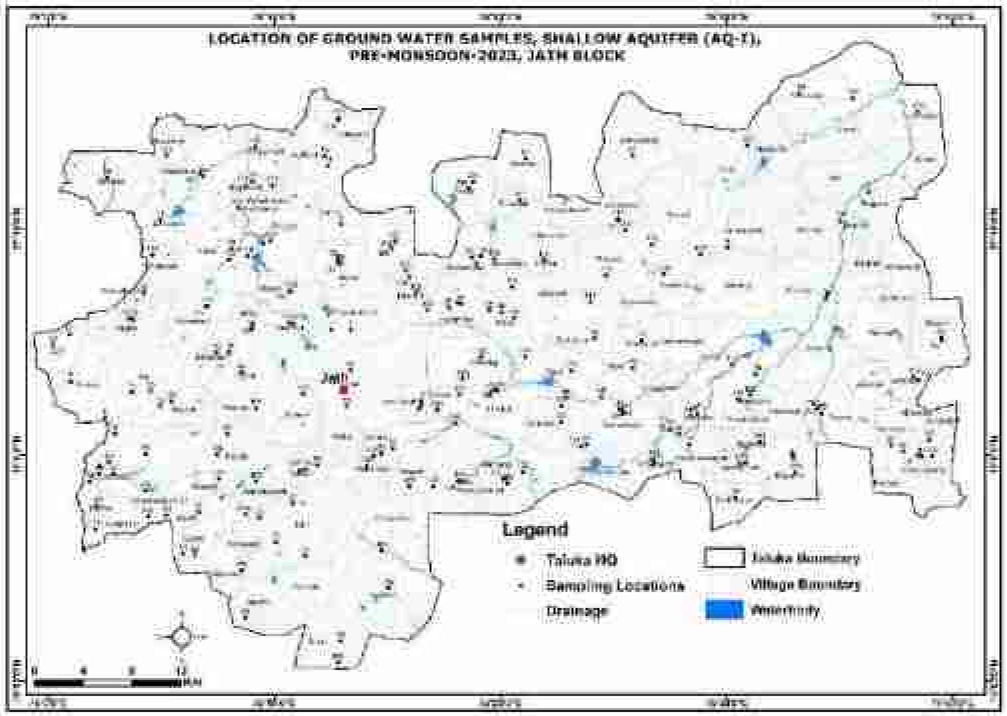



**Figure-8.1:** Location of GW Samples, Shallow aquifer, Pre-23.

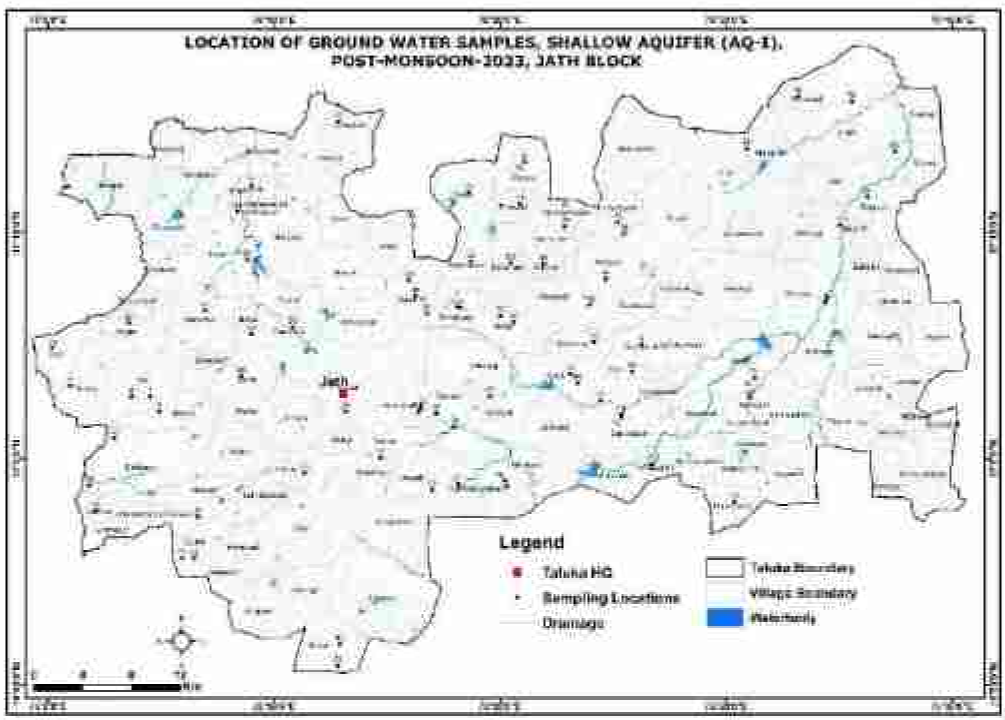



**Figure-8.2:** Location of GW Samples, Shallow aquifer, Post-23.

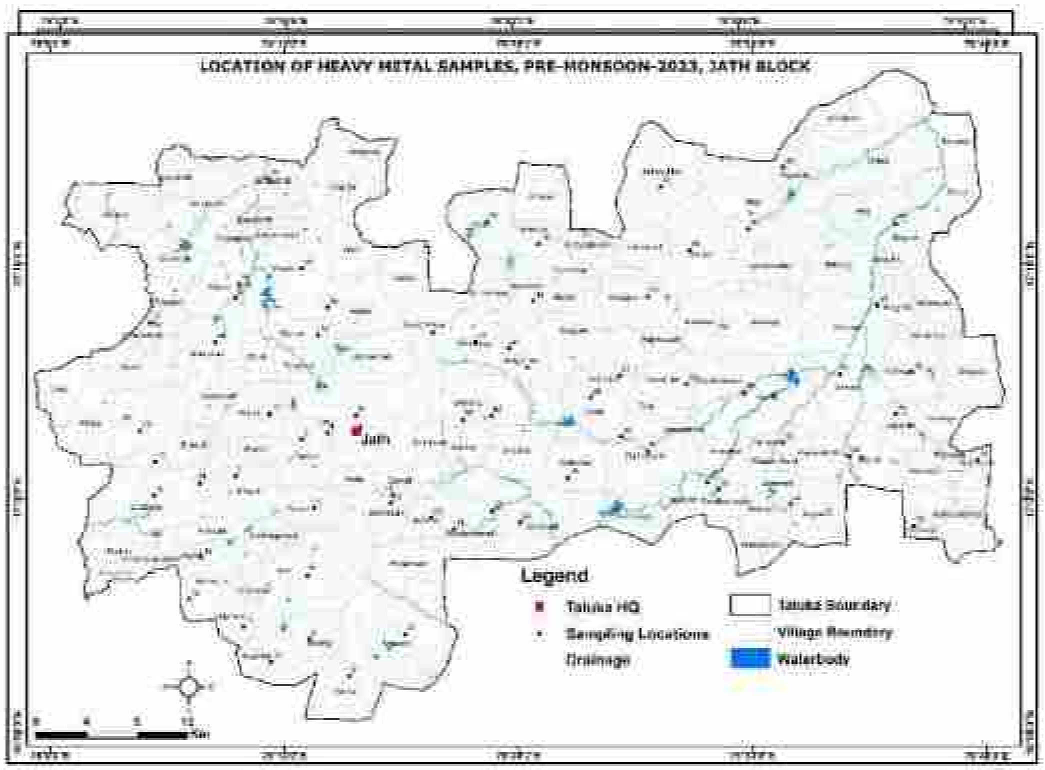



**Figure-8.3:** Location of GW Samples, Deeper aquifer, Pre-23.

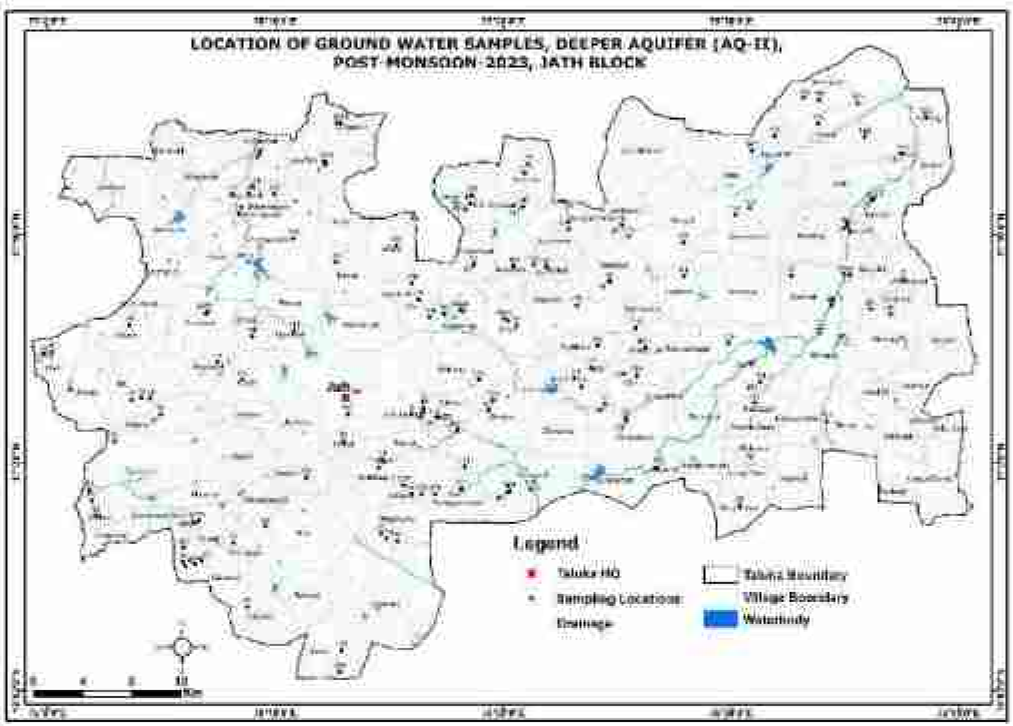



**Figure-8.4:** Location of GW Samples, Deeper aquifer, Post-23.

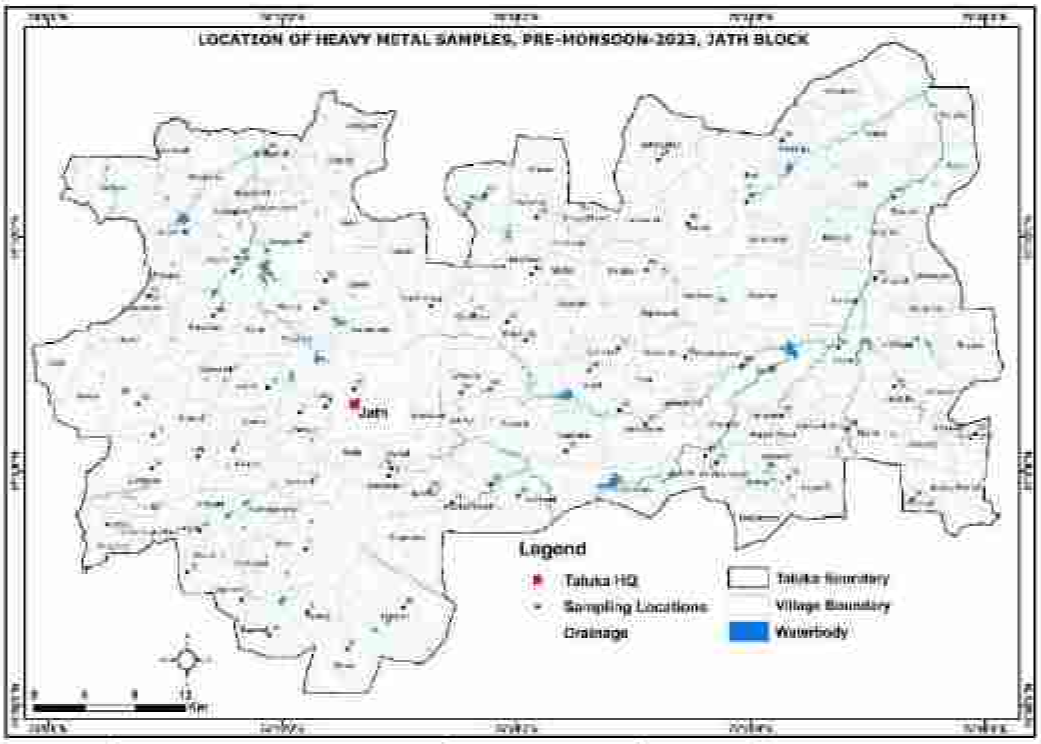



**Figure-8.5:** Location of Heavy metals samples, Pre,23.

## 8.3 Results and Discussion:

The major ion chemistry of samples collected during pre and post-monsoon season from shallow (aquifer-1) and deeper (aquifer-2) is presented in **Annexures-V to VIII**. Apart from these samples, another, 19 ground water samples (from 10 wells) were collected from exploratory/observation/Pz wells drilled in the area (**Table-8.1**).

### 8.3.1 Pre-monsoon Season (Shallow Aquifer-Aquifer-1)

In general, Ground water is neutral to mildly alkaline in nature as pH ranges from 6.65 to 8.24 (Avg:7.47). Electrical conductivity (EC) ranges from 367 to 12130 µS/cm at 25°C (Avg: 2159) (**Figure-8.6**). From Figure-8.6, it is observed that low EC (<750) is observed in south-eastern and in patches in central eastern and eastern part and in major part of area (61%), EC is in the range of 750-2250 and high EC in the range of 2250 to 3000 is observed in eastern, central and north-eastern part covering 13% of area and it is also observed that, in 38 samples EC is more than 3000 µS/cm and covers, about 22.5 % of area. The higher concentration of EC in Ground water is mainly due to mineralization (longer residence time) and less dilution due to low rainfall in the area

Temperature of Ground water during pre-monsoon, varies between 22.5 $^0$C and 39.4 $^0$C with an average of 31$^0$C. Concentration of total dissolved solids (TDS) varies from 235 to 7763 mg/L (Avg:1382) and total hardness (TH) varies between 115 to 3725 mg/L (Avg:623). It is observed that in 36 samples, TDS is beyond maximum permissible limits of BIS (2000 mg/L) and in 55 samples, TH is beyond maximum permissible limits of BIS (600 mg/L).

The concentration of major cat ions like $Ca^{2+}$, $Mg^2$+, $Na^+$ and $K^+$ varies between 14 to 721 mg/L (Avg:117), 2 to 550 mg/L (Avg:81), 23 to 1112 mg/L (Avg:189) and 0 to 125 mg/L (Avg:4) respectively.

The concentration of major an ions like $CO_3^{2-}$, $HCO_3^-$, $Cl^-$, $SO_4^{2-}$, $NO_3^-$ and $F^-$ varies between 0 to 36 mg/L, 104 to 915 mg/L (Avg:375), 11 to 2311 mg/L (Avg:282), 11 to 2998 (Avg:331), Below detectable limit to 317 mg/L (avg:39) and 0.28 to 2.8 mg/L (Avg:0.68) respectively. The total alkalinity which is function of carbonate and bi-carbonate present in water. It is observed that in 8 samples, alkalinity is more than maximum permissible limits of 600 mg/L. It is observed that in 16 and 49 samples chloride & sulphate concertation's is beyond maximum permissible limits of BIS, i.e., 1000 mg/L and 400 mg/L respectively. The spatial distribution of fluoride concentration during pre-monsoon season is plotted on **Figure-8.7** and concentration of nitrate is plotted on **Figure-8.8**. It is observed that, in about 98% of samples, fluoride concentration is within maximum permissible limits of BIS (1.5 mg/L) and in 5 samples located in eastern part covering an area of 1.2% it is beyond maximum permissible limits of BIS. It is observed that in 72% samples, nitrate concentration is within maximum permissible limits of BIS (45 mg/L) and fit for human consumptions and 57 samples (28%) are unfit for human consumptions.

The concentration of uranium in ground water varies from below detectable limit to 19.34 parts per billion (ppb) with average of 3.1 ppb and is well within permissible limits of BIS (30 ppb).

### 8.3.2 Post-monsoon Season (Shallow Aquifer-Aquifer-1)

In general, Ground water is neutral to mildly alkaline with pH ranges from 7.25 to 7.98 (Avg:7.61). EC ranges from 560 to 9922 µS/cm at 25°C (Avg: 2890). The areal distribution of EC is presented in **Figure-8.9** and it is observed that, low EC (<750) is observed in very small area around Lakdewadi village. Electrical conductivity in the range of 750-2250 is observed in central-western and northern part and high EC in the range of 2250 to 3000 and >3000 is observed in eastern, south-central and in patches in north-western and central-western part covering an area of 17.5% & 40.4 % respectively. Concentration of total hardness (TH) varies between 210 to 3620 mg/L (Avg:888 mg/L).

The concentration of major cat ions like $Ca^{2+}$, $Mg^{2}+$, $Na^{+}$ and $K^{+}$ varies between 34 to 677 mg/L (Avg:170), 17 to 588 mg/L (Avg:113), 21 to 1190 mg/L (Avg:244) and 0 to 61 mg/L (Avg:6) respectively.

The concentration of major an ions like $HCO_3^-$, $Cl^-$, $SO_4^{2-}$, $NO_3^-$ and $F^-$ varies between 128 to 744 mg/L (Avg:373), 14 to 1801 mg/L (Avg:537), 10 to 3108 mg/L (Avg:537), 0 to 135 (Avg:55) and 0.18 to 2.6 mg/L (Avg:0.6) respectively. The spatial distribution of fluoride concentration during pre-monsoon season is plotted on **Figure-8.10** and concentration of nitrate is plotted on **Figure-8.11**. It is observed that, in about 96% of samples, fluoride concentration is within maximum permissible limits of drinking water standards of BIS (1.5 mg/L) and in 3 samples covering 2.3% of area from central and southern part (in patches) it is beyond maximum permissible limits of BIS. It is observed that 43 % samples (33 nos), nitrate concentration is within maximum permissible limits of BIS (45 mg/L).

The concentration of uranium in ground water varies from 0.04 to 27.3 parts per billion (ppb) with average of 4.88 ppb and is well within permissible limits of BIS.

### 8.3.3 Pre-monsoon Season (Deeper Aquifer-Aquifer-2)

In general, Ground water is neutral to mildly alkaline with pH ranges from 6.87 to 9.03 (Avg:7.52). EC ranges from 346 to 11132 μS/cm at 25°C (Avg: 1735) (**Figure-8.12**). From Figure-8.12, it is observed that low EC (<750) is observed in central western, northern and south-eastern part of area, EC is in the range of 750-2250 is spread in major part of area and high EC in the range of 2250 to 3000 is observed in north-eastern, south-central and north-western part covering 11% area. It is also observed that in 28 samples covering 10.2%, EC is more than 3000 μS/cm.

Concentration of total dissolved solids (TDS) varies from 222 to 7124 mg/L (Avg:1110 mg/L) and total hardness (TH) varies between 60 to 4080 mg/L (Avg:468 mg/L). It is observed that in 26 & 55 samples, TDS and TH is more than 2000 mg/L and 600 mg/L respectively.

The concentration of major cat ions like $Ca^{2+}$, $Mg^{2}+$, $Na^{+}$ and $K^{+}$ varies between 8 to 717 mg/L (Avg:93), 2 to 578 mg/L (Avg:57), 26 to 1367 mg/L (Avg:163) and 0 to 112 mg/L (Avg:4) respectively.

The concentration of major an ions like $CO_3^{2-}$, $HCO_3^-$, $Cl^-$, $SO_4^{2-}$, $NO_3^-$ and $F^-$ varies between 0 to 99 mg/L, 61 to 1141 mg/L (Avg:340), 14 to 2524 mg/L (Avg:229), 9 to 2572 (Avg:232, Below detectable limit to 320 mg/L (avg:37) and 0.23 to 3.9 mg/L (Avg:0.8) respectively. It is observed that in 9 samples, alkalinity is more than maximum permissible limits of 600 mg/L. It is observed that in 9 and 42 samples chloride & sulphate concertation's is beyond maximum permissible limits of BIS, i.e., 1000 mg/L and 400 mg/L respectively.

The spatial distribution of fluoride concentration during pre-monsoon season is plotted on **Figure-8.13** and concentration of nitrate is plotted on

**Figure-8.14**. It is observed that, in about 90% of samples, fluoride concentration is within maximum permissible limits of BIS (1.5 mg/L) and in 23 samples mostly located in north-eastern part covering an area of 6.5% it is beyond maximum permissible limits of BIS. It is also observed that in 71% samples, nitrate concentration is within maximum permissible limits of BIS (45 mg/L) and fit for human consumptions and 65 samples (27%) are unfit for human consumptions.

The concentration of uranium in ground water varies from below detectable limit to 19.05 parts per billion (ppb) with average of 3.13 ppb and is well within permissible limits of BIS (30 ppb).

### 8.3.4 Post-monsoon Season (Deeper Aquifer-Aquifer-2)

In general, Ground water is neutral to mildly alkaline with pH ranges from 7.14 to 8.79 (Avg:7.64). Electrical conductivity (EC) ranges from 418 to 9922 µS/cm at 25°C (Avg: 2413) with exception of high EC of 14180 at Balgaon village. The areal distribution of EC is presented in **Figure-8.15** and it is observed that low EC (<750) occurs in small patches. Electrical conductivity in the range of 750-2250 occupies most of area and high EC (2250-3000 and > 3000) is observed in eastern, central, north-western and south-eastern part covering an area of 23 % and 27 % respectively.

Concentration of total hardness (TH) varies between 25 to 2920 mg/L (Avg:675 mg/L) with exception of high TH (3620 and 5080 mg/L) at 2 sites (Ravulgundwadi and Balgaon).

The concentration of major cat ions like $Ca^{2+}$, $Mg^{2}+$, $Na^{+}$ and $K^{+}$ varies between 6 to 890 mg/L (Avg:147), 2 to 695 mg/L (Avg:86), 21 to 1190 mg/L (Avg:220), 0 to 62 mg/L (Avg:5) respectively.

The concentration of major an ions like $CO_3^{2-}$, $HCO_3^-$, $Cl^-$, $SO_4^{2-}$, $NO_3^-$ and $F^-$ varies between 0 to 12 mg/L, 31 to 1050 mg/L (Avg:352), 14 to 3261 mg/L (Avg:348), 4 to 3108 (Avg:415), Below detectable limit to 209 mg/L (avg:54) and 0.2 to 5.0 mg/L (Avg:0.7) respectively. The spatial distribution of fluoride concentration during pre-monsoon season is plotted on **Figure-8.16** and concentration of nitrate is plotted on **Figure-8.17**. It is observed that, in about 93% of samples, fluoride concentration is within maximum permissible limits of BIS (1.5 mg/L) and in rest 7 % samples (12 nos), located in north-eastern part, southern part and in other two patches covering an area of 4.75%, it is beyond maximum permissible limits of drinking standards. It is observed that in 48% samples, nitrate concentration is within maximum permissible limits of BIS (45 mg/L) and in 52 % samples (86 nos) it is beyond maximum permissible limits of BIS.

The concentration of uranium in ground water varies from 0 to 27.336 parts per billion (ppb) with average of 4.9 ppb and is well within permissible limits of BIS.

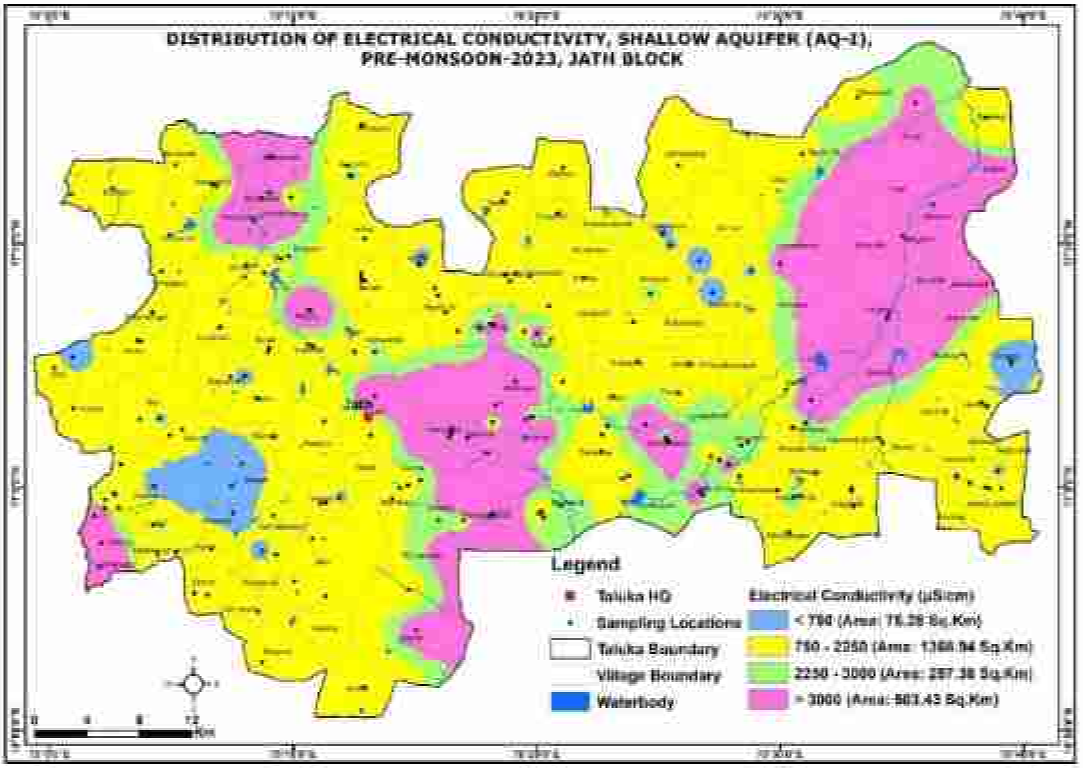



**Figure-8.6:** Distribution of EC, Shallow Aquifer-Pre-23.

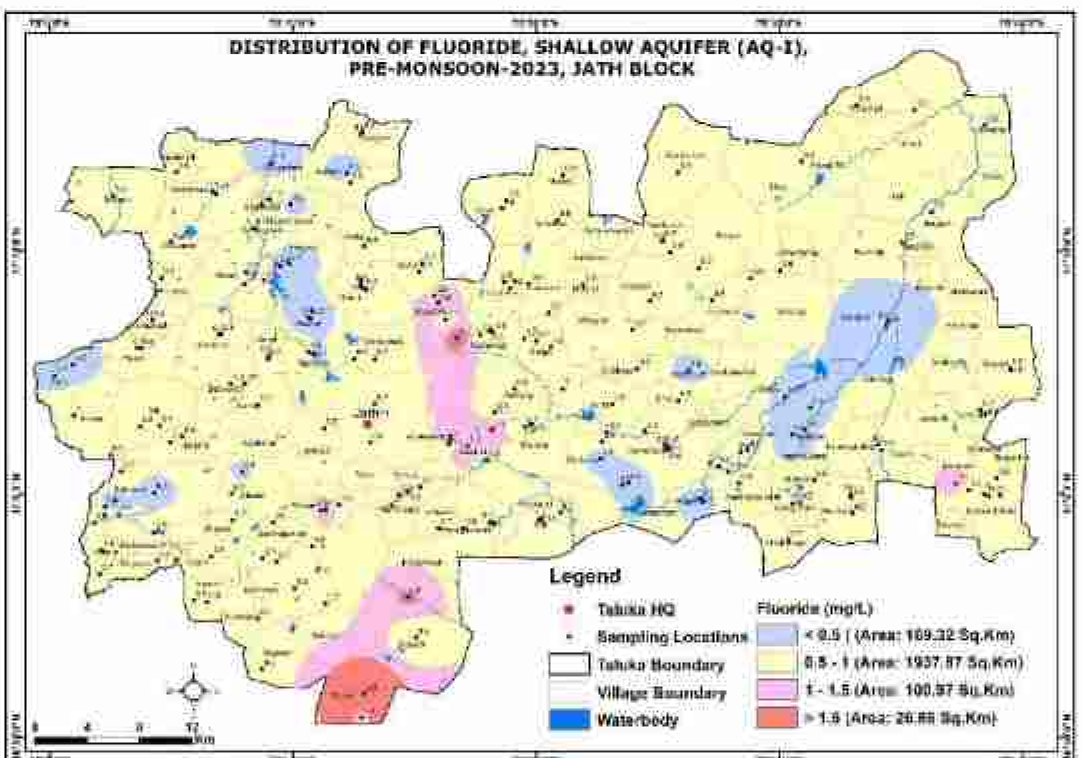



**Figure-8.7:** Distribution of F, Shallow Aquifer-Pre-23.

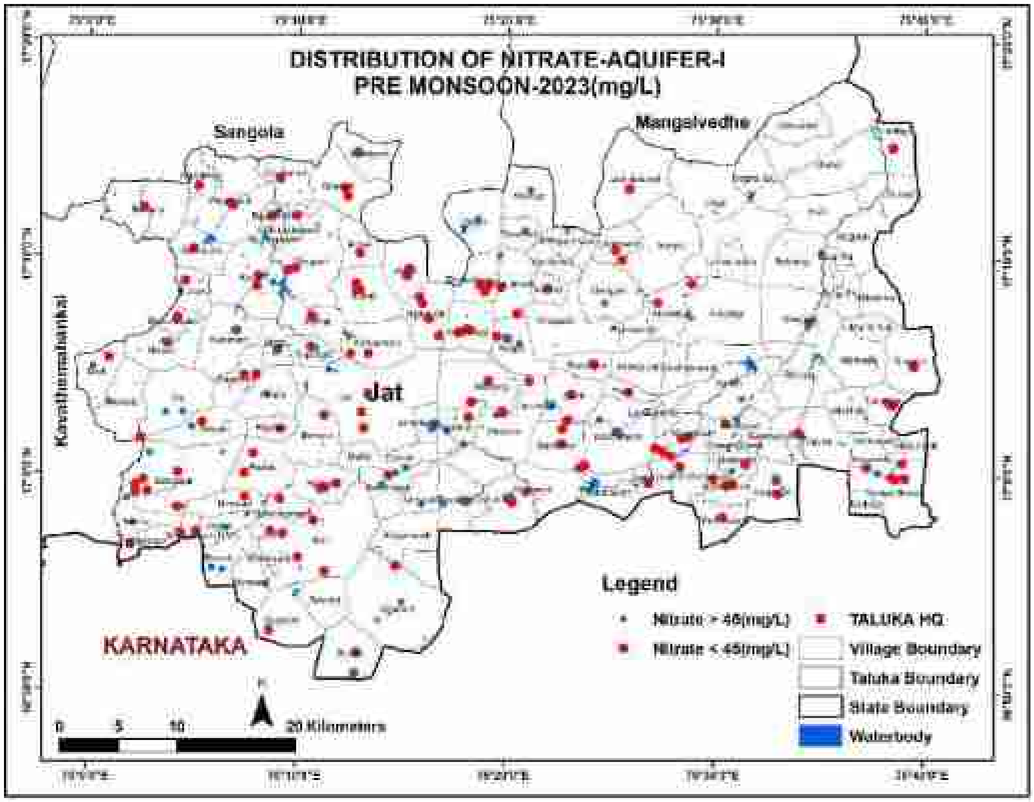



**Figure-8.8:** Distribution of $NO_3$, Shallow Aquifer-Pre-23.

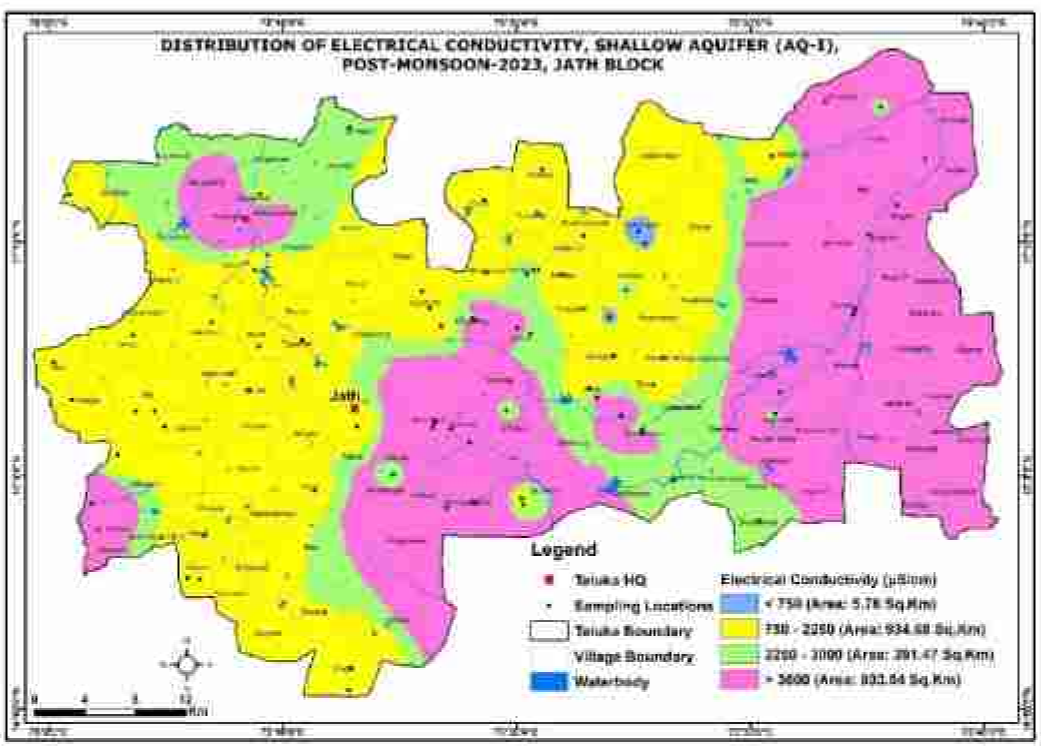



**Figure-8.9:** Distribution of EC, Shallow Aquifer-Post-23.

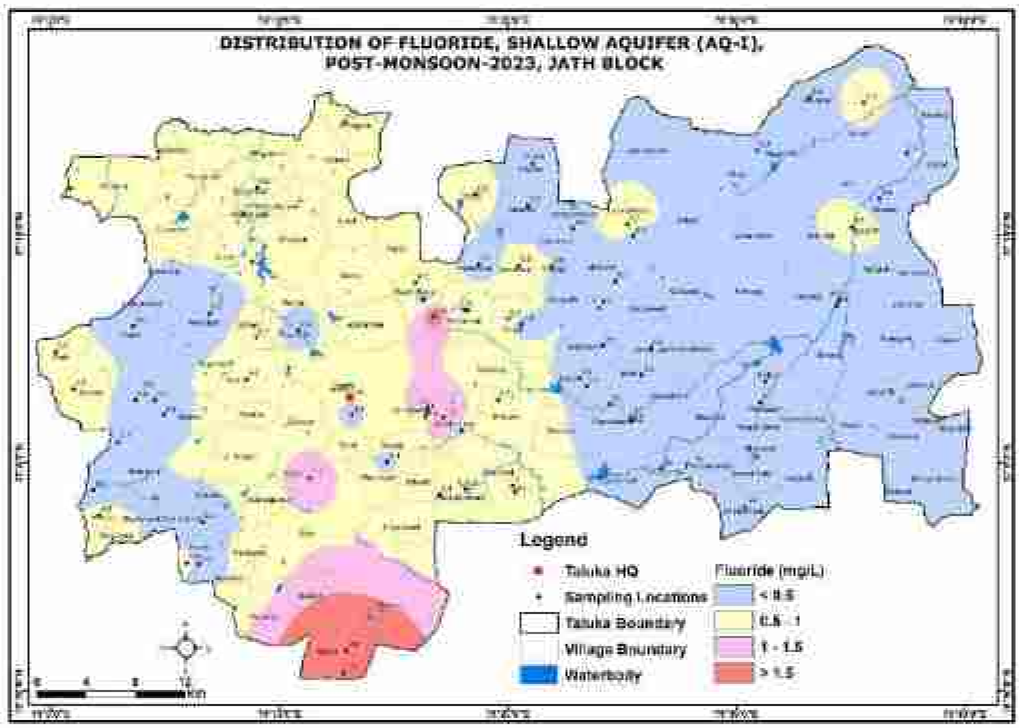



**Figure-8.10:** Distribution of F, Shallow Aquifer-Post-23.

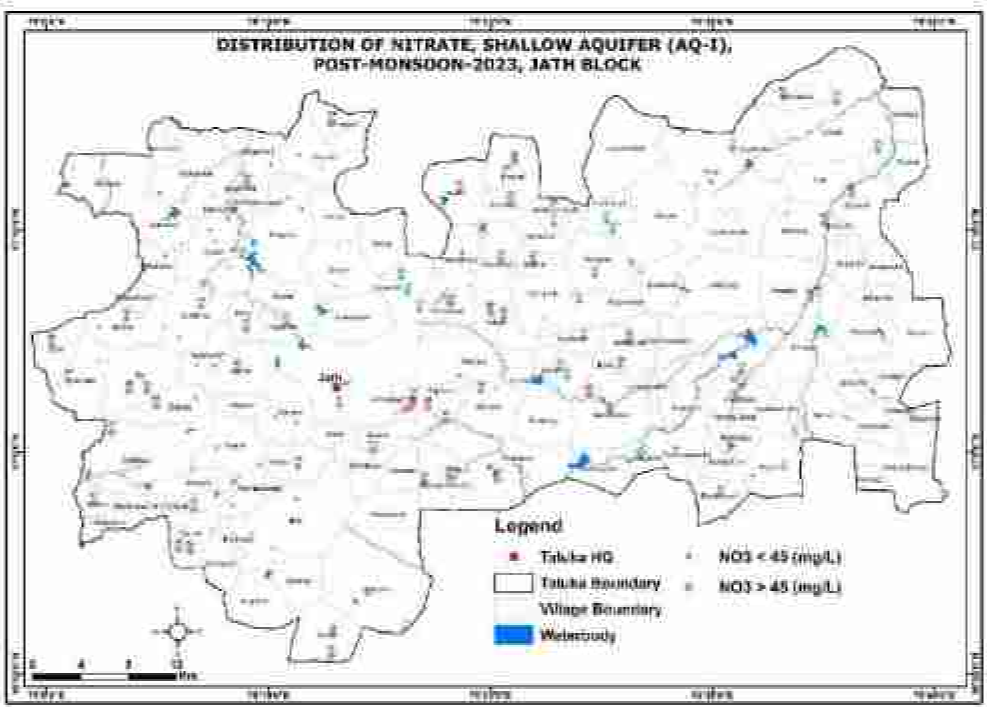



**Figure-8.11:** Distribution of $NO_3$, Shallow Aquifer-Post-23.

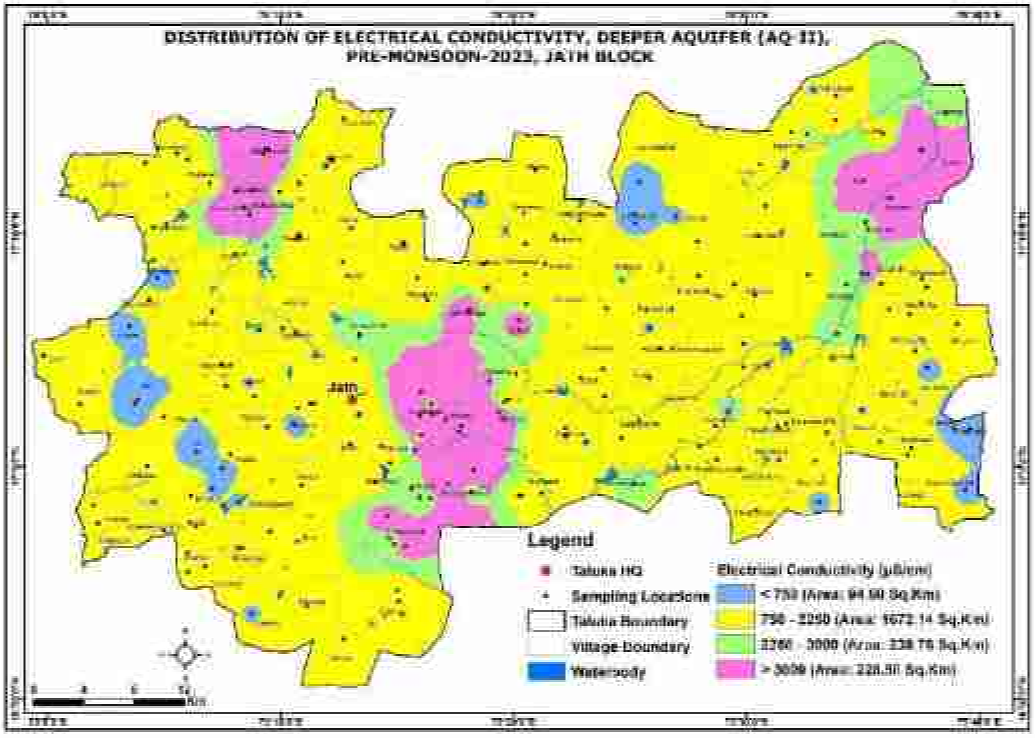



**Figure-8.12:** Distribution of EC, Deeper Aquifer-Pre-23.

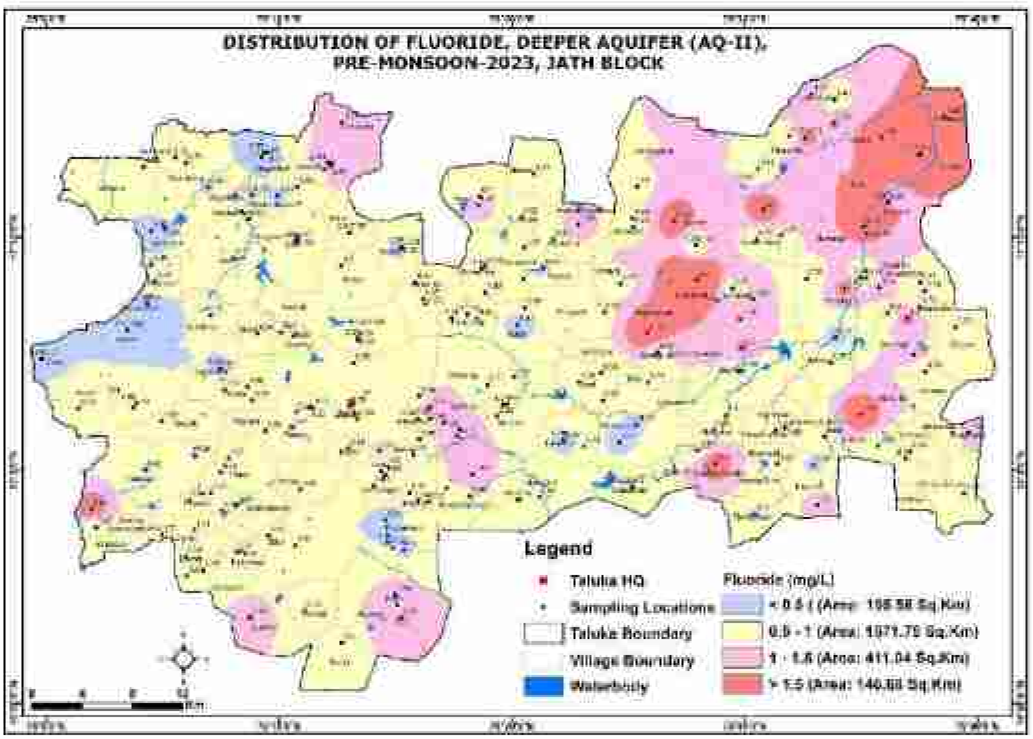



**Figure-8.13:** Distribution of Fluoride, Deeper Aquifer-Pre-23.

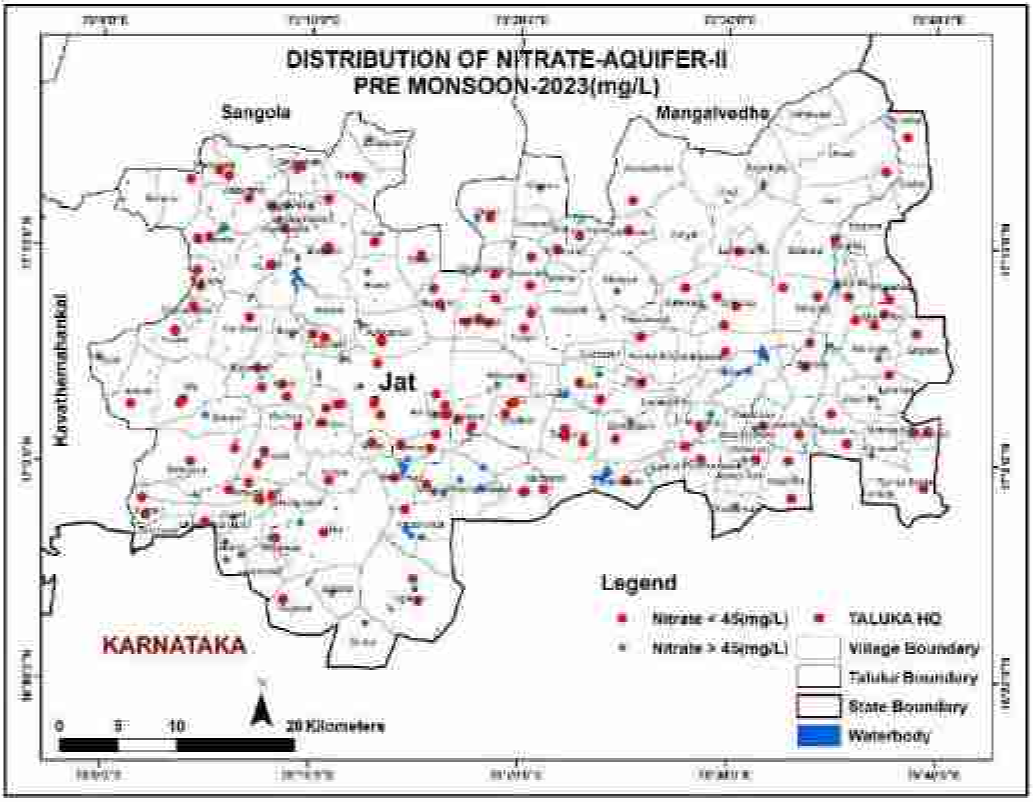



**Figure-8.14:** Distribution of Nitrate, Deeper Aquifer-Pre-23.

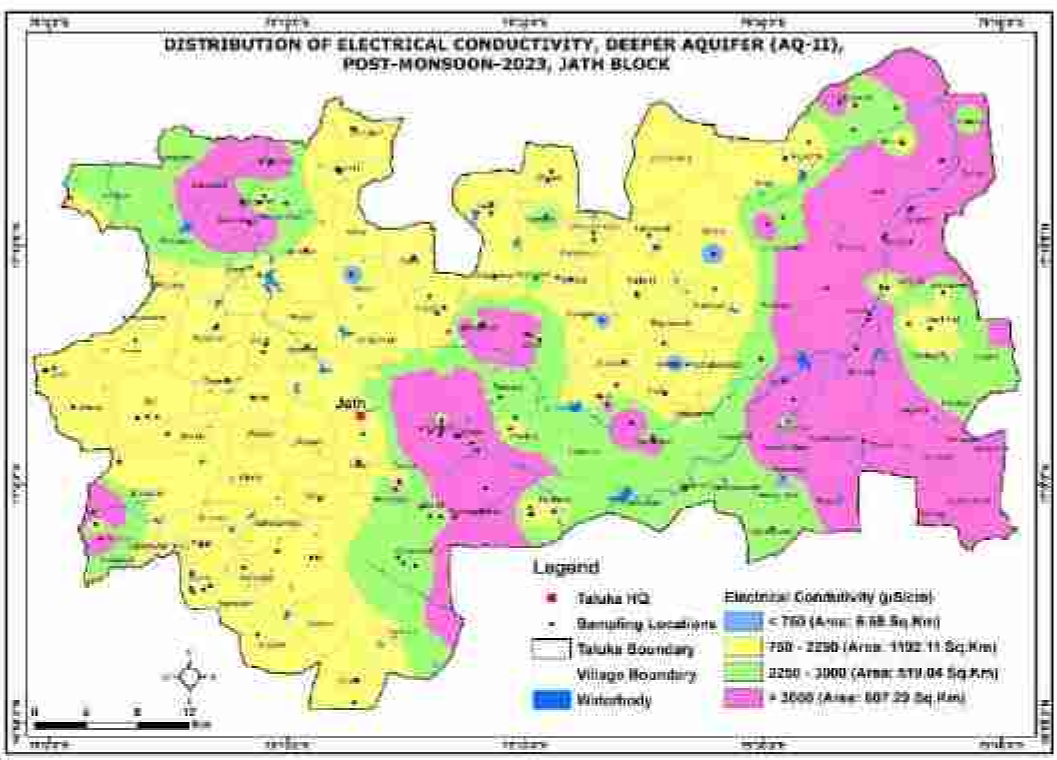



**Figure-8.15:** Distribution of EC, Deeper Aquifer-Post-23.

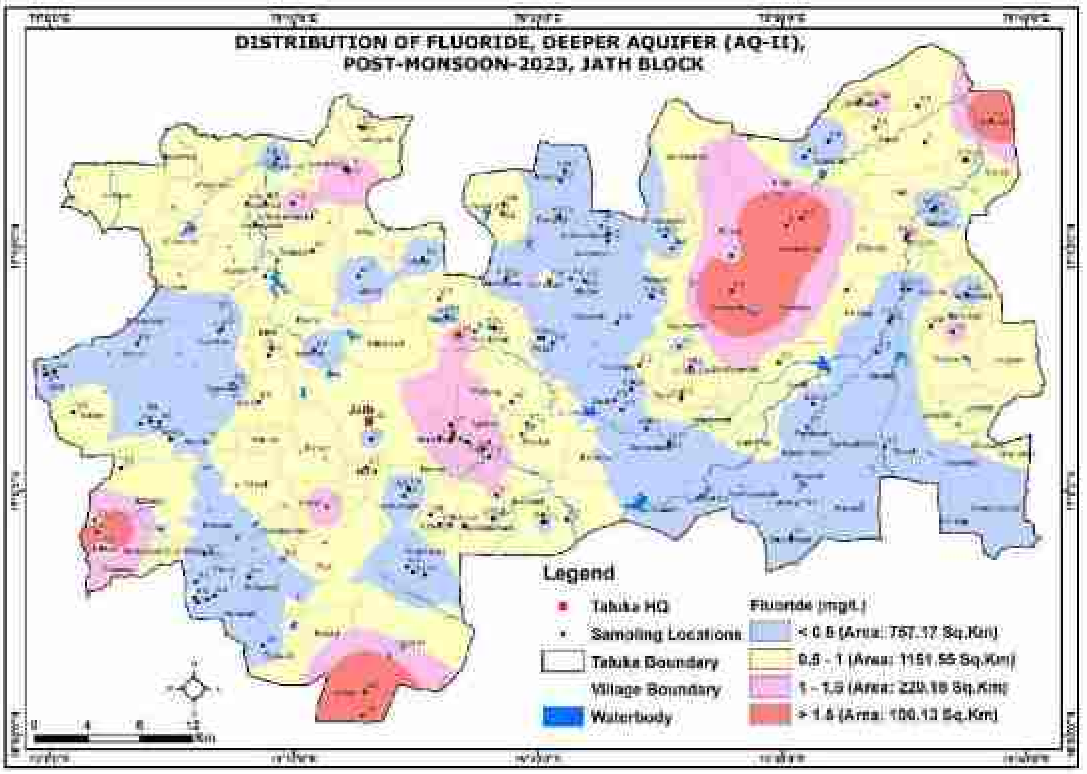



**Figure-8.16:** Distribution of Fluoride, Deeper Aquifer-Post-23.

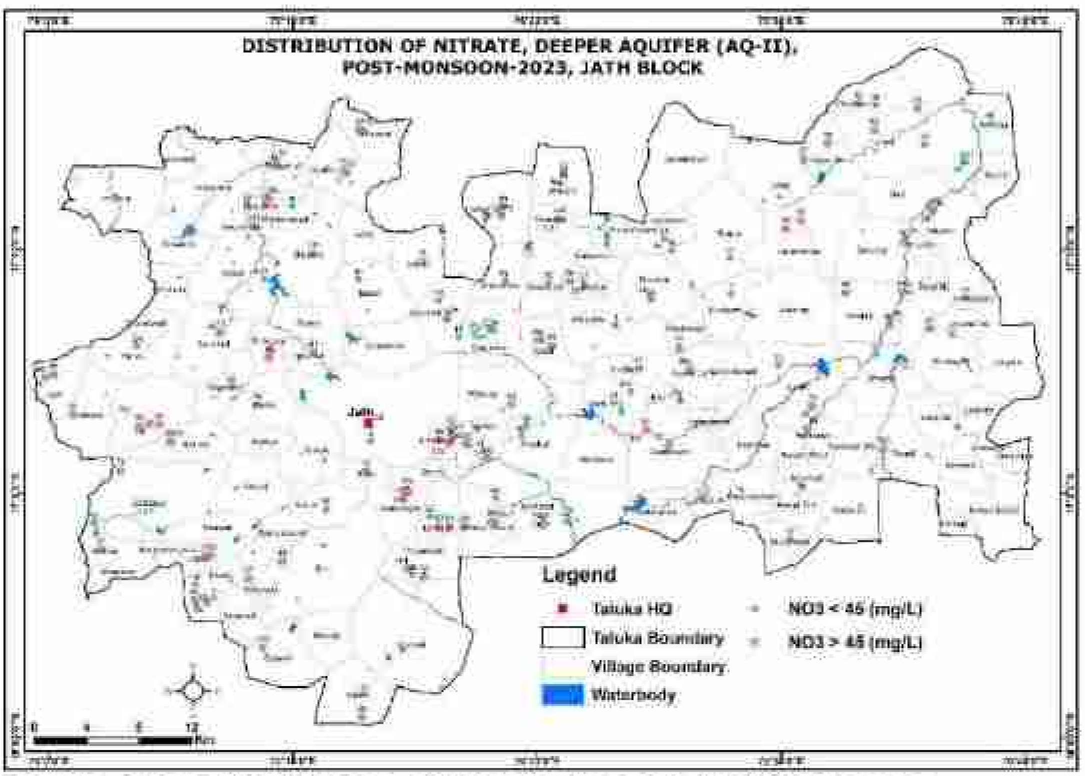



**Figure-8.17:** Distribution of Nitrate, Deeper Aquifer-Post-23.

### 8.3.5 Ground Water Quality from Exploratory Wells:

Total 19 ground water samples were collected from exploratory/observation/Pz wells drilled in the area (**Table-8.1).** Results reveals that, pH varies from 6.9 to 8.0 (avg:7.5) and is of alkaline in nature. Electrical conductivity (EC), and Total Hardness varies from 363 to 1095 µS/cm at 25°C (avg:780) and 90 to 395 mg/L (avg:224) respectively. The major cat ions like Ca, Mg, Na and K varies from 10-80 mg/L (avg:42), 9 to 56 mg/L (avg:29), 26 to 136 mg/L (avg:72) and below detectable limits to 2 (avg:1) respectively. The major an ions like $HCO_3$, Cl, $SO_4$, $NO_3$ and F ranges between 92 to 476 mg/L (avg:308), 14 to 170 mg/L (avg:65), 9 to 145 mg/L (avg:56), 0 to 66 mg/L (avg:11) and 0.3 to 1.4 mg/L (avg:07) respectively. It is observed that progressive increase in F concentration is observed at Hivre site as concentration of F increases from 0.3 mg/L in shallow aquifer (22.6-25.7 m) to 0.5 mg/L in second aquifer (80.6-83.6 m) and to 0.6 mg/L in deeper aquifer (135.5-138.5 m). The Ground water quality from exploratory wells is suitable for drinking except one sample located at Sindhur village.

### 8.3.6 Presence of heavy metals during pre-monsoon Season:

Total 67 ground water samples were collected during pre-monsoon of 2023 and analysed for 18 trace elements viz. Boran (B), Aluminium (Al), Chromium (Cr), Manganese (Mn), Iron (Fe), Nickel (Ni), Copper (Cu), Zink (Zn), Arsenic (As), Selenium (Se), Strontium (Sr), Molybdenum (Mo), Silver (Ag), Cadmium (Cd), Barium (Ba), Mercury (Hg), Lead Pb and Uranium (U) content. The summarised results are given in **Annexure-IX.** On perusal of data, it is observed that in 2 samples collected from Jalayl (Bk), Se and Hg is beyond maximum permissible limits of BIS and samples collected from Karajanagi, mercury is beyond maximum permissible limits of BIS.

**Table-8.1:** Major Ion Chemistry of Ground Water Samples from Exploratory Wells Drilled During-2023.

| S. No. | Location | Type | pH | EC | TH | Ca | Mg | Na | K | $HCO_3$ | Cl | $SO_4$ | $NO_3$ | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Hivre-Zone-1 | OW | 8.0 | 363 | 130 | 34 | 11 | 26 | 1 | 207 | 14 | 9 | 0 | 0.3 |
| 2 | Hivre-Zone-2 | OW | 7.5 | 744 | 245 | 80 | 11 | 66 | 1 | 366 | 32 | 45 | 9 | 0.5 |
| 3 | Hivre -Zone-3 | OW | 7.4 | 723 | 210 | 64 | 12 | 70 | 1 | 342 | 35 | 46 | 7 | 0.6 |
| 4 | Yeldhari | EW | 7.6 | 846 | 310 | 42 | 50 | 66 | 1 | 384 | 74 | 69 | 8 | 0.6 |
| 5 | Jath-Zone-1 | EW | 7.5 | 882 | 295 | 50 | 41 | 69 | 1 | 354 | 85 | 62 | 7 | 0.6 |
| 6 | Jath-Zone-2 | EW | 7.5 | 845 | 305 | 52 | 43 | 61 | 1 | 360 | 78 | 67 | 3 | 0.6 |
| 7 | Jath-PYT | EW | 7.5 | 869 | 295 | 52 | 40 | 62 | 1 | 360 | 78 | 59 | 5 | 0.6 |
| 8 | Daflapur | EW | 7.7 | 829 | 100 | 26 | 9 | 136 | 2 | 134 | 167 | 72 | 5 | 1.4 |
| 9 | Sindhur | EW | 7.8 | 1044 | 235 | 56 | 23 | 110 | 1 | 183 | 170 | 69 | 66 | 1.0 |
| 10 | Hivare-Zone-1 | EW | 7.6 | 678 | 195 | 24 | 33 | 63 | 1 | 323 | 28 | 40 | 18 | 0.6 |
| 11 | Hivare -Zone-2 | EW | 7.6 | 617 | 170 | 32 | 22 | 67 | 1 | 293 | 28 | 43 | 14 | 0.6 |
| 12 | Hivare-Zone -3 | EW | 7.6 | 642 | 165 | 26 | 24 | 66 | 1 | 299 | 28 | 37 | 14 | 0.6 |
| 13 | Hivare-PYT | EW | 7.5 | 631 | 190 | 28 | 29 | 62 | 1 | 311 | 28 | 44 | 17 | 0.6 |
| 14 | Jath APT | EW | 7.5 | 1095 | 395 | 66 | 56 | 56 | 0 | 476 | 67 | 75 | 4 | 0.4 |
| 15 | Jath | OW | 7.6 | 672 | 175 | 34 | 22 | 73 | 0 | 281 | 53 | 44 | 10 | 0.6 |
| 16 | Asangi Turk | EW | 7.5 | 1022 | 335 | 56 | 47 | 60 | 1 | 409 | 78 | 60 | 3 | 0.4 |
| 17 | Tilyal | EW | 7.3 | 822 | 90 | 18 | 11 | 131 | 1 | 92 | 124 | 145 | 10 | 1.4 |
| 18 | Hivare | EW | 7.7 | 774 | 200 | 10 | 43 | 67 | 1 | 342 | 32 | 39 | 18 | 0.6 |
| 19 | Singanahalli | Pz | 6.9 | 716 | 220 | 50 | 23 | 52 | 2 | 336 | 28 | 37 | 0 | 0.5 |

(**Note:** No $CO_3$ is detected in these wells).

# CHAPTER -9

## AREAS SHOWING SIGNS OF LAND SUBSIDENCE

### 9.1 Objectives:

In order to deliver this deliverable, published literature from the area, along with signs of subsidence observed during field is to be considered. The data processing involves, analysis of satellite data with published literature and field observations.

### 9.2 Material and Methods:

Land subsidence is a process where the surface is gradually settling or sudden sinking due to various reasons like earthquakes, sudden drop in water table etc. This phenomenon is observed mostly in areas where soils are loose or in tectonically disturbed areas where numerous fults and folds are present and in areas where soils are having predominant clayey or sandy layer etc.

In order to delineate areas showing signs of land subsidence in Jath taluka, field traverses were taken in an entire area, discussed the problems with farmers and local people.

As geologically, the area is underlain by hard basalt rocks, in which primary porosity is negligible, if present it is very low and secondary porosity is developed due to weathering and fracturing where movement of groundwater is controlled by porosity in basalt rock.

### 9.3 Results and Discussion:

After detailed investigations, it is found that no land subsidence is found in the area.

# CHAPTER-10

## GROUND WATER SUITABILITY FOR DRINKING & IRRIGATION NEEDS and QUALITY MANAGEMENT INTERVENTIONS

### 10.1 Objectives:

Assessing ground water quality is as important as assessing its quantity. Rainwater, which is main source for ground water recharge as it, infiltrates through soil, interacts with carbon dioxide and turns acidic and then dissolves minerals present in soil, and eventually water becomes neutral to mildly alkaline. This pristine water then joins with ground water system, flows down gradient and joins ground water table and becomes more mineralized over time and distance.

Due to anthropogenic influences, ground water quality is deteriorating to such an extent, it is rendered unsuitable for drinking and agricultural purposes, in certain areas. Once ground water is polluted, its effects may continue for indefinite period, as natural dilution is slow, artificial flushing is expensive and treatment is impractical. In this regard, evaluation of ground water quality in terms of physical and chemical characteristics is warranted to determine its suitability for drinking and irrigation uses and to suggest remedial measures to protect it from further deterioration.

### 10.2 Material and Methods:

Ground water quality data of 2023 from both aquifers and for two seasons (**Annexure-5 to 8**), is used in assessing suitability for drinking purpose (Bureau of Indian Standards (BIS)) (IS: 10500:1991, 2012) and for irrigation purposes and to suggest management interventions including demarcation of safe areas. The aquifer wise locations are annexed in 3 and 4 annexures. The classification of ground water samples during pre-monsoon and post-monsoon season for drinking water purposes are tabulated in **Table-10.1** to **Table-10.4**.

**Table-10.1:** Classification of GW Samples as per Drinking Water Standards from Shallow Aquifer (Pre-23).

| Parameter | Drinking water Standards (IS-10500-2012) | | Samples < DL | | Samples between DL and MPL | | Samples > MPL | |
|---|---|---|---|---|---|---|---|---|
| | DL | MPL | Samples | % | Samples | % | Samples | % |
| pH | 6.5-8.5 | - | 0 | 0 | 201 | 100 | 0 | 0 |
| TH | 200 | 600 | 20 | 10 | 126 | 63 | 55 | 28 |
| Ca | 75 | 200 | 103 | 51 | 71 | 35 | 27 | 13 |
| Mg | 30 | 100 | 46 | 23 | 115 | 57 | 40 | 20 |
| Cl | 250 | 1000 | 141 | 70 | 44 | 22 | 16 | 8 |
| $SO_4$ | 200 | 400 | 127 | 63 | 25 | 12 | 49 | 24 |
| $NO_3$ | 45 | No relaxation | 144 | 72 | 0 | 0 | 57 | 28 |
| F | 1 | 1.5 | 187 | 93 | 9 | 4 | 5 | 2 |

(All values in mg/L except pH, DL= Desirable Limit; MPL= Maximum Permissible Limit).

**Table-10.2:** Classification of GW Samples as per Drinking Water Standards from Deeper Aquifer (Pre-23).

| Parameter | Drinking water Standards (IS-10500-2012) | | Samples < DL | | Samples between DL and MPL | | Samples > MPL | |
|---|---|---|---|---|---|---|---|---|
| | DL | MPL | Samples | % | Samples | % | Samples | % |
| pH | 6.5-8.5 | - | 0 | 0 | 222 | 100 | 1 | 0 |
| TH | 200 | 600 | 48 | 22 | 120 | 54 | 55 | 24 |
| Ca | 75 | 200 | 120 | 54 | 81 | 37 | 22 | 10 |
| Mg | 30 | 100 | 95 | 43 | 92 | 42 | 36 | 17 |
| Cl | 250 | 1000 | 158 | 71 | 56 | 25 | 9 | 4 |
| $SO_4$ | 200 | 400 | 152 | 68 | 29 | 13 | 42 | 19 |
| $NO_3$ | 45 | No relaxation | 159 | 71 | 0 | 0 | 64 | 29 |
| F | 1 | 1.5 | 180 | 81 | 20 | 9 | 23 | 10 |

(All values in mg/L except pH, DL= Desirable Limit; MPL= Maximum Permissible Limit).

**Table-10.3:** Classification of GW Samples as per Drinking Water Standards from Shallow Aquifer (Post-23).

| Parameter | Drinking water Standards (IS-10500-2012) | | Samples < DL | | Samples between DL and MPL | | Samples > MPL | |
|---|---|---|---|---|---|---|---|---|
| | DL | MPL | Samples | % | Samples | % | Samples | % |
| pH | 6.5-8.5 | - | 76 | 100 | 0 | 0 | 0 | 0 |
| TH | 200 | 600 | 0 | 0 | 40 | 53 | 36 | 47 |
| Ca | 75 | 200 | 24 | 32 | 28 | 37 | 24 | 32 |
| Mg | 30 | 100 | 9 | 12 | 42 | 55 | 25 | 33 |
| Cl | 250 | 1000 | 41 | 54 | 25 | 33 | 10 | 13 |
| $SO_4$ | 200 | 400 | 39 | 51 | 7 | 9 | 30 | 39 |
| $NO_3$ | 45 | No relaxation | 33 | 43 | 0 | 0 | 43 | 57 |
| F | 1 | 1.5 | 70 | 92 | 3 | 4 | 3 | 4 |

(All values in mg/L except pH, DL= Desirable Limit; MPL= Maximum Permissible Limit).

**Table-10.4:** Classification of GW Samples as per Drinking Water Standards from Deeper Aquifer (Post-23).

| Parameter | Drinking water Standards (IS-10500-2012) | | Samples < DL | | Samples between DL and MPL | | Samples > MPL | |
|---|---|---|---|---|---|---|---|---|
| | DL | MPL | Samples | % | Samples | % | Samples | % |
| pH | 6.5-8.5 | - | 165 | 100 | 0 | 0 | 1 | 0 |
| TH | 200 | 600 | 15 | 9 | 88 | 53 | 63 | 38 |
| Ca | 75 | 200 | 63 | 38 | 62 | 37 | 41 | 25 |
| Mg | 30 | 100 | 43 | 26 | 84 | 51 | 39 | 23 |
| Cl | 250 | 1000 | 94 | 57 | 58 | 35 | 14 | 8 |
| $SO_4$ | 200 | 400 | 88 | 53 | 28 | 17 | 50 | 30 |
| $NO_3$ | 45 | No relaxation | 80 | 48 | 0 | 0 | 86 | 52 |
| F | 1 | 1.5 | 141 | 85 | 13 | 8 | 12 | 7 |

(All values in mg/L except pH, DL= Desirable Limit; MPL= Maximum Permissible Limit).

US Salinity Laboratory (USSL) Classification is widely used for evaluating ground water suitability for irrigation purpose. Other parameter like Electrical Conductivity (EC), Sodium Absorption Ratio (SAR), Residual Sodium Carbonate (RSC) and % Sodium present in ground water are also considered for describing quality for deciding suitability for irrigation.

USSL diagram describes 16 classes with reference to Sodium Absorption Ratio (SAR) as an index for sodium hazard and EC as an index for salinity hazard. The 9 important classes are described below.

- $C_1S_1$: Low salinity and low sodium waters are good for irrigation and can be used with most of crops with no restriction on use on soils.
- $C_2S_1$: Medium salinity and low sodium waters are good for irrigation and can be used on all most all soils with a little danger of development of harmful levels of exchangeable sodium if moderate amount of leaching occurs. Crops can be grown without any special consideration for salinity control.
- $C_3S_1$: The high salinity and low sodium waters require good drainage. Crops with good salt tolerance should be selected.
- $C_3S_2$: High salinity and medium sodium waters require good drainage and can be used on coarse textured or organic soils having good permeability.
- $C_3S_3$: These high salinity and high sodium waters require special soil management, good drainage, high leaching and organic matter additions. Gypsum amendments make feasible the use of these waters.
- $C_4S_1$: Very high salinity and low sodium waters are not suitable for irrigation unless the soil must be permeable and drainage must be adequate. Irrigation waters must be applied in excess to provide considerable leaching. Salt tolerant crops must be selected.
- $C_4S_2$: Very high salinity and medium sodium waters are not suitable for irrigation on fine textured soils and low leaching conditions and

can be used for irrigation on coarse textured or organic soils having good permeability.

- $C_4S_3$: Very high salinity and high sodium water produces harmful levels of exchangeable sodium in most soils and will require special soil management, good drainage, high leaching and organic matter additions. Gypsum amendments makes feasible the use of these waters.
- $C_4S_4$: Very high salinity and very high sodium waters are generally unsuitable for irrigation purpose. These are sodium $Cl^-$ type of waters and can cause sodium hazard, can be used on coarse textured soils with very good drainage for very high salt tolerant crops. Gypsum amendments make feasible the use of these waters.

Irrigation water classification based on US Salinity Laboratory Staff (1954) diagram is given in **Table-10.5.**

***Table-10.5:*** *Classification of Irrigation Water Based on EC and SAR (*After *US Salinity Laboratory Staff, 1954).*

| S. No. | Class | EC and SAR | REMARKS |
|---|---|---|---|
| 1 | $C_1S_1$ | < 250 µS/cm<br>SAR < 10 | Low salinity and low sodium hazard |
| 2 | $C_2S_2$ | < 250 – 750 µS/cm<br>SAR < 18 | Medium salinity and medium sodium hazard |
| 3 | $C_3S_3$ | < 750- 2250 µS/cm<br>SAR < 26 | High salinity and high sodium hazard |
| 4 | $C_4S_4$ | < 2250-5000 µS/cm<br>SAR > 26 | Very high salinity and very high sodium hazard |

### 10.3 Results and Discussion:

#### 10.3.1 Hydrochemical Facies:

Piper diagram is widely used in understanding hydro-chemical facies of ground water. Values of chemical parameters from shallow and deeper aquifers for pre and post-monsoon season are plotted in Piper diagram **(Figure-10.1a-b and 10.2a-b)**. The summarised results are given in **Table-10.6**.

**Shallow Aquifer:** Variations of water types from shallow aquifer during pre and post monsoon are observed in ground water samples. During pre-monsoon season, major types of water is Ca-Na-$HCO_3$-Cl (21% samples), Na-Ca-$HCO_3$ (18 %), Ca-$HCO_3$ (16 %) and Ca-Na-Cl (15%) and rest, falls in other classes. During post-monsoon season, major types of water are Ca-Na-Cl (25% samples), Ca-Cl (22%), Ca-Na-$HCO_3$-Cl (20%) and rest falls in other classes.

**Deeper Aquifer:** Variations of water types from Deeper aquifer during pre and post monsoon are observed in ground water samples. During pre-monsoon season major types of water is Ca-Na-$HCO_3$-Cl (25 % samples), Ca-Na-Cl (18%), Ca-Na-$HCO_3$ (16 %), and rest, falls in other classes. During post-monsoon season the major types of water are Ca-Na-Cl (27 %), Ca-Na-$HCO_3$-Cl (22 %), Ca-Cl (15%) and rest falls in other classes.

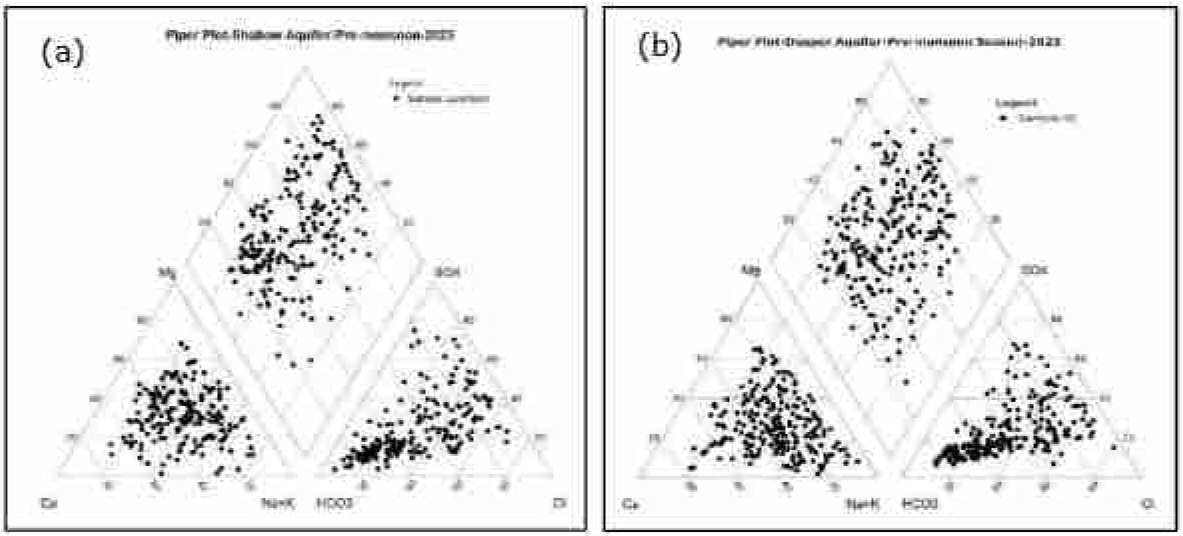



**Figure-10.1a-b:** Type of ground water, pre-monsoon season-23.

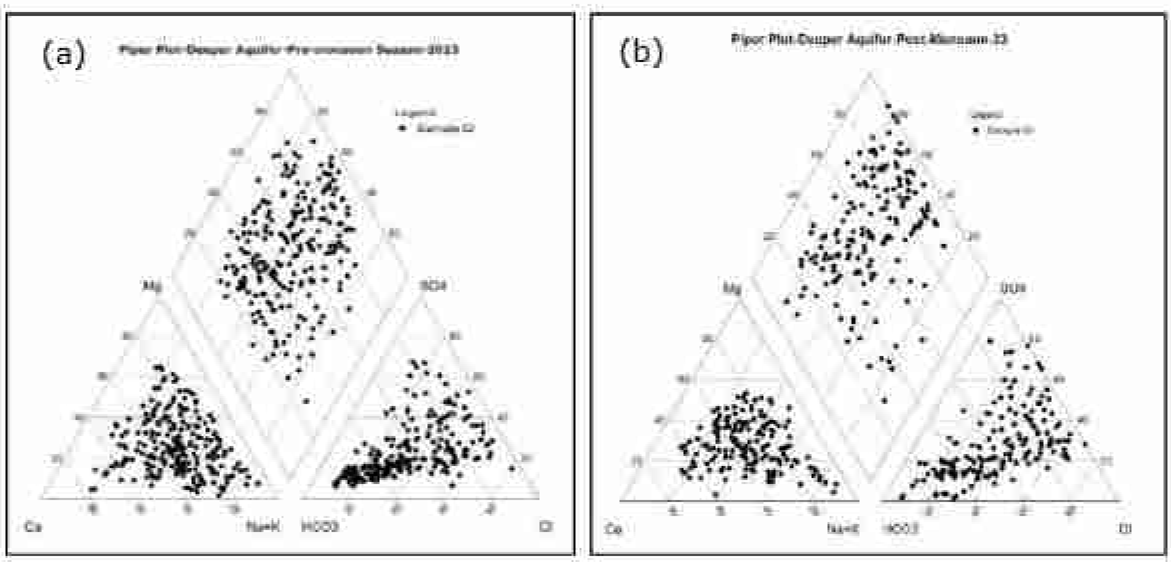



**Figure-10.2a-b:** Type of ground water, post-monsoon season-23.

**Table-10.6:** Type of Ground Water During Pre & Post-monsoon Season from Shallow and Deeper Aquifers-2023.

| Area | Type of water | Shallow Aquifer | | Deeper Aquifer | |
|---|---|---|---|---|---|
| | | Pre (201 nos) | Post (73 nos) | Pre (223 nos) | Post (166 nos) |
| 1 | Calcium-bicarbonate ($Ca-HCO_3$) | 32 (16%) | 12 (16%) | 14 (6%) | 17 10%) |
| 2 | Calcium-bicarbonate-chloride ($Ca-HCO_3-Cl$) | 23 (11%) | 6 (8%) | 22 (10%) | 13(8%) |
| 3 | Calcium-chloride (Ca-Cl) | 18 (9%) | 17 (22%) | 13 (6%) | 25 (15%) |
| 4 | Calcium-sodium-bicarbonate ($Ca-Na- HCO_3$) | 37 (18%) | 5 (7%) | 35 (16%) | 13 (8%) |
| 5 | Calcium-sodium-bicarbonate-chloride ($Ca-Na-HCO_3-Cl$) | 43 (21%) | 15 (20%) | 56 (25%) | 37(22%) |
| 6 | Calcium-sodium- chloride (Ca-Na-Cl) | 31 (15%) | 19 (25%) | 41 (18%) | 45 (27%) |
| 7 | Sodium- bicarbonate ($Na-HCO_3$) | 5 (3%) | 1(1%) | 12 (5%) | 6 (4%) |
| 8 | Sodium-bicarbonate-chloride ($Na-HCO_3-Cl$) | 6 (3%) | 0 | 15 (7%) | 6 (4 %) |
| 9 | Sodium-Chloride (Na-Cl) | 6 (3%) | 1 (1%) | 15 (7%) | 4 (2%) |

### 10.3.2 Relationship Between Fluoride and Other Ions

**Scatter Plot:** Scatter plot used to observe relationship between two variables. To study relationship between $F^-$ and other parameters like pH, $Ca^{2+}$, $Na^+$ and $HCO_3^-$, data from shallow and deeper aquifers for pre as well as post-monsoon seasons have been plotted as scatter plots and discussed below (**Figure-10.3a-b and 10.4a-b**).

The plot of $F^-$ vs. pH shows, a weak positive correlation ($r^2$ = 0.047) in shallow aquifers during pre-monsoon season and a weak negative correlation ($r^2$=0.021) during post-monsoon season. In deeper aquifers, it shows a weak positive correlation in pre ($r^2$ = 0.037) and post-monsoon ($r^2$ =0.106) seasons, which indicates that, higher alkalinity in ground water promotes leaching of $F^-$ (Sahoo and Karim, 1989; Agrawal *et al.*, 1997; Saxena and Ahmed, 2001; Madhnure *et al.*, 2007).

The correlation plot of $F^-$ vs. $Ca^{2+}$ shows a week negative relationship ($r^2$ = 0.019 and 0.028) in shallow aquifers during pre and post-monsoon season. Inverse relationship is observed in deeper aquifers during pre and post-monsoon seasons ($r^2$=-0.0217 and 0.034 respectively).

In the process of chemical weathering as mineral changes to montmorillonite phase, sodium is released into ground water, which is supported by plot of $Na^+$ vs. $F^-$, which shows a weak positive correlation during pre and post-monsoon seasons in both aquifers, i.e., $r^2$ = 0.0075 & 0.0185 and $r^2$ = 0.0157 & 0.0166, in shallow and deeper aquifers respectively. Apambire *et al.* (1997) have also observed that $Na^+$ concentration increases with $F^-$, thereby increasing solubility of fluorite in ground water.

Fluoride ($F^-$) and HCO3$^-$ pair shows a positive correlation in ground waters from shallow aquifers during pre as well as post-monsoon seasons ($r^2$ = 0.0157 and 0.012). A weak inverse relationship between $F^-$ and $HCO_3^-$ is noticed ($r^2$ =-0.047 and 0.01) in deeper aquifers during pre as well post-monsoon seasons and similar relationship is also observed by other workers (Apambire *et al.*, 1997; Kruse and Ainchil, 2003; Rukah and Alsokhny, 2003; Madhnure *et al.*, 2007). Occurrence of carbonate is mainly dependent on pH of ground water, when there is no fresh carbonate in the geochemical environment, bicarbonate present in ground water precipitates as carbonate (CGWB, 2002) and during this process bicarbonate breaks continuously to supply $CO_2$ required for the chemical weathering of minerals. In this way there will be a conversion of bicarbonate into carbonate continuously and pH of the system starts increasing (CGWB, 2002).

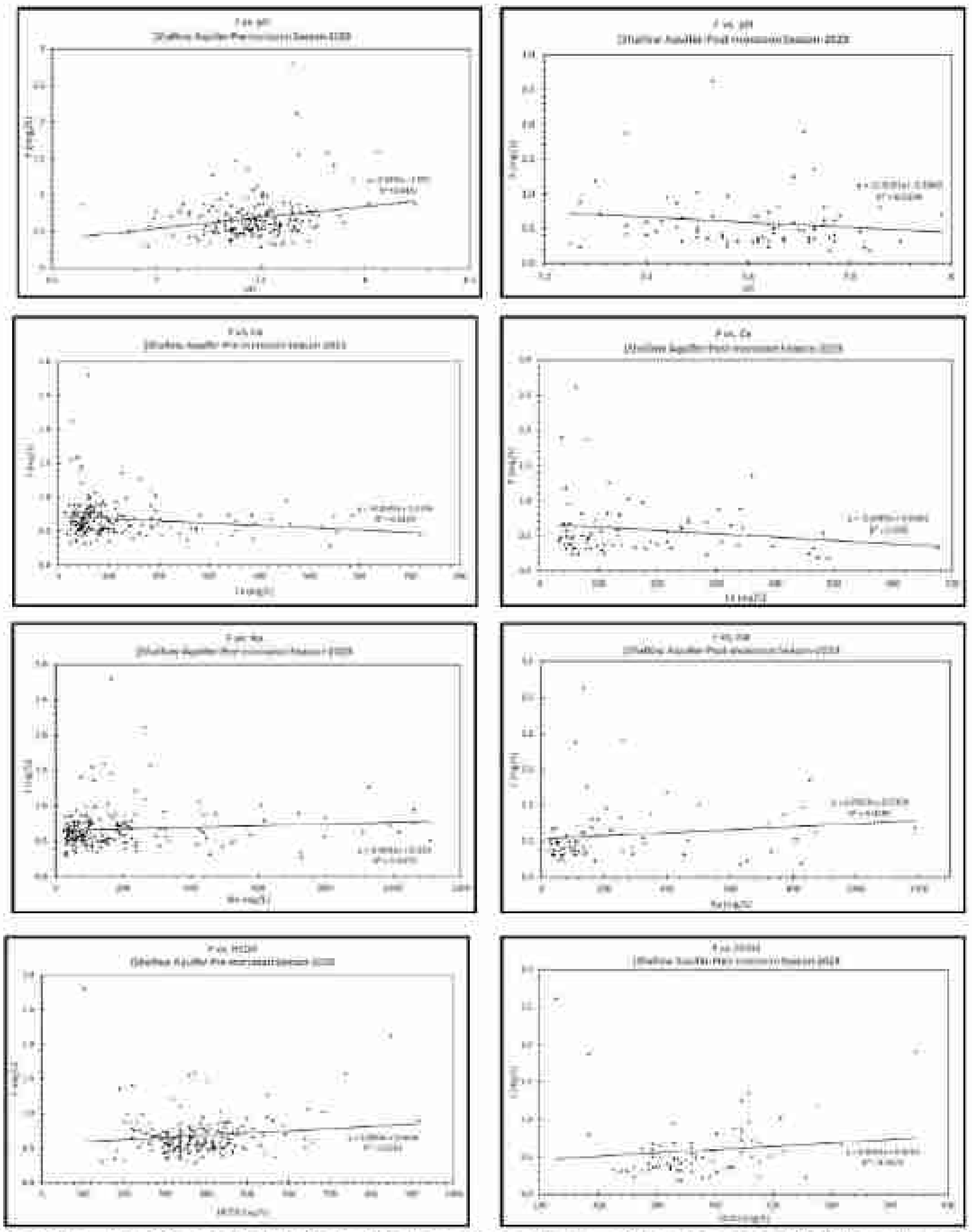


**Figure-10.3a-b:** Relationship between F vs. other ions in Shallow Aquifer.

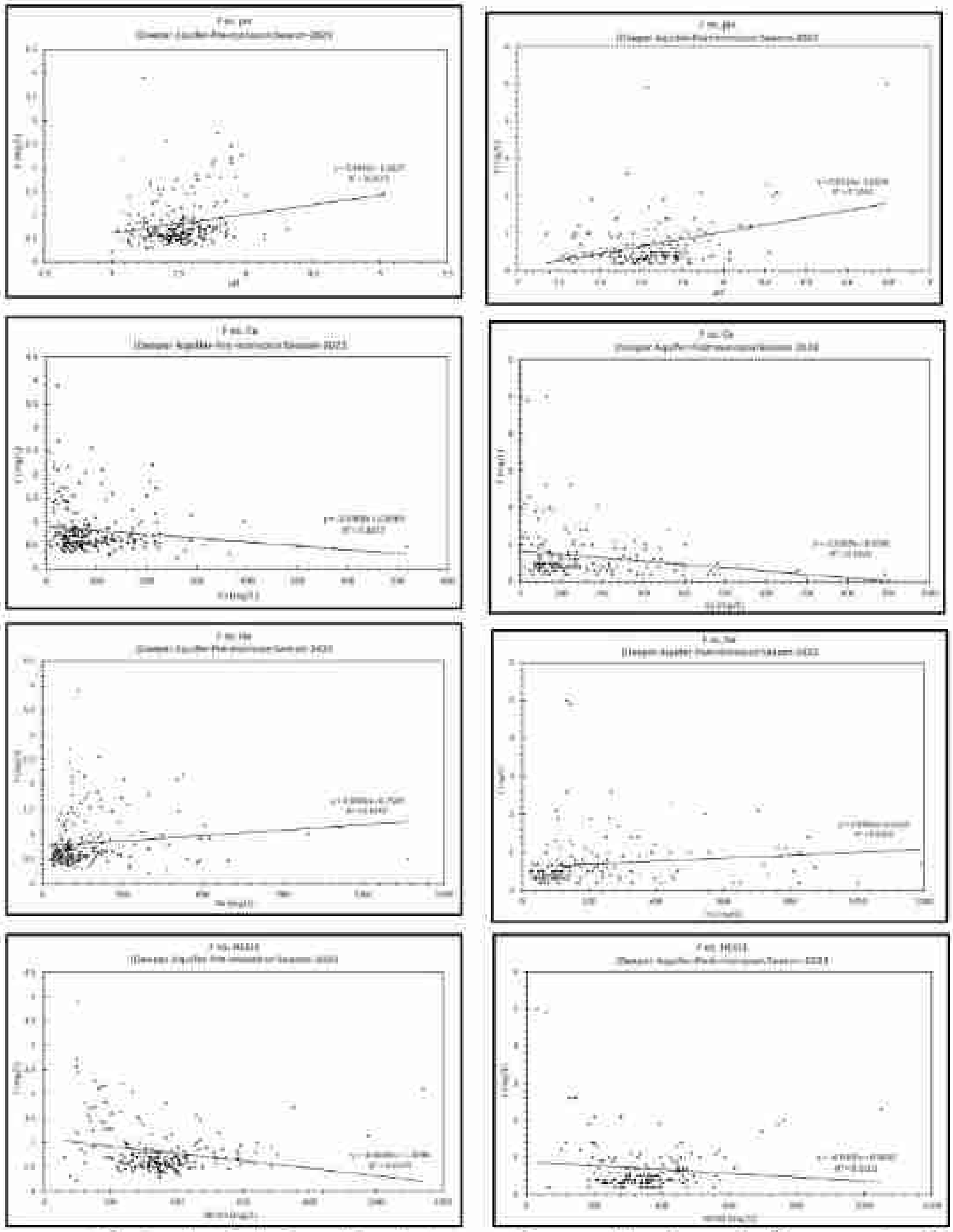


**Figure-10.4a-b:** Relationship between F vs. other ions in Deeper Aquifer.

**Correlation Coefficients:**

Correlation coefficient is a statistical numerical method that gives statistical relationship between two variables. Its values range between -1 to 1 (-1 for negative and 1 for positive) (strong positive:0.8 to 1; moderate positive:0.8 to 0.4; weak positive:0.4 to 0 and no relationship:0). In the present study, data of chemical constituents is utilised to generate correlation coefficients for shallow and deeper aquifers for pre and post-monsoon seasons (**Table-10.7 to 10.10**).

In shallow aquifer during pre-monsoon season, pH shows weak positive correlation with $F^-$ (0.22) and weak negative correlation (-0.16) and in deeper aquifers, in both seasons' pH shows weak positive correlation with $F^-$ (0.19 & 0.35).

**Table-10.7:** Correlation Matrix, Shallow Aquifer-Pre-monsoon Season.

| | **pH** | **EC** | **Na** | **Ca** | **Mg** | **K** | **$HCO_3$** | **Cl** | **$SO_4$** | **$NO_3$** | **F** |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **pH** | 1 | -0.10 | 0.01 | -0.20 | -0.14 | 0.08 | 0.06 | -0.15 | -0.05 | -0.16 | 0.22 |
| **EC** | | 1.00 | 0.93 | 0.80 | 0.93 | 0.08 | 0.25 | 0.94 | 0.93 | 0.41 | -0.04 |
| **Na** | | | 1.00 | 0.59 | 0.80 | 0.11 | 0.36 | 0.84 | 0.88 | 0.35 | 0.08 |
| **Ca** | | | | 1.00 | 0.67 | 0.03 | -0.01 | 0.76 | 0.79 | 0.41 | -0.15 |
| **Mg** | | | | | 1.00 | 0.01 | 0.22 | 0.90 | 0.84 | 0.34 | -0.08 |
| **K** | | | | | | 1.00 | 0.14 | 0.04 | 0.05 | 0.18 | -0.04 |
| **$HCO_3$** | | | | | | | 1.00 | 0.16 | 0.15 | 0.13 | 0.11 |
| **Cl** | | | | | | | | 1.00 | 0.77 | 0.39 | -0.10 |
| **$SO_4$** | | | | | | | | | 1.00 | 0.32 | 0.00 |
| **$NO_3$** | | | | | | | | | | 1.00 | -0.08 |
| **F** | | | | | | | | | | | 1.00 |

**Table-10.8:** Correlation Matrix, Shallow Aquifer-Post-monsoon Season.

| | pH | EC | Na | Ca | Mg | K | $HCO_3$ | Cl | $SO_4$ | $NO_3$ | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **pH** | 1.00 | 0.12 | 0.23 | 0.10 | -0.04 | -0.13 | 0.14 | -0.01 | 0.13 | -0.13 | -0.16 |
| **EC** | | 1.00 | 0.90 | 0.79 | 0.13 | -0.23 | 0.86 | 0.11 | 0.86 | -0.16 | -0.20 |
| **Na** | | | 1.00 | 0.80 | 0.28 | 0.03 | 0.81 | 0.22 | 0.87 | 0.08 | 0.06 |
| **Ca** | | | | 1.00 | 0.50 | 0.29 | 0.68 | 0.17 | 0.90 | 0.34 | 0.30 |
| **Mg** | | | | | 1.00 | 0.90 | 0.34 | -0.21 | 0.42 | 0.92 | 0.91 |
| **K** | | | | | | 1.00 | -0.01 | 0.28 | 0.15 | 0.98 | 0.99 |
| **$HCO_3$** | | | | | | | 1.00 | 0.01 | 0.65 | 0.06 | 0.02 |
| **Cl** | | | | | | | | 1.00 | 0.06 | 0.10 | 0.09 |
| **$SO_4$** | | | | | | | | | 1.00 | 0.19 | 0.17 |
| **$NO_3$** | | | | | | | | | | 1.00 | 0.99 |
| **F** | | | | | | | | | | | 1.00 |

**Table-10.9:** Correlation Matrix, Deeper Aquifer-Pre-monsoon Season.

| | pH | EC | Na | Ca | Mg | K | $HCO_3$ | Cl | $SO_4$ | $NO_3$ | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **pH** | 1.00 | -0.26 | -0.11 | -0.34 | -0.27 | -0.04 | -0.17 | -0.24 | -0.22 | -0.27 | 0.19 |
| **EC** | | 1.00 | 0.93 | 0.75 | 0.89 | 0.02 | 0.38 | 0.93 | 0.90 | 0.56 | -0.03 |
| **Na** | | | 1.00 | 0.57 | 0.76 | 0.02 | 0.40 | 0.83 | 0.86 | 0.44 | 0.13 |
| **Ca** | | | | 1.00 | 0.54 | -0.02 | 0.14 | 0.74 | 0.68 | 0.52 | -0.15 |
| **Mg** | | | | | 1.00 | -0.02 | 0.43 | 0.82 | 0.79 | 0.52 | -0.12 |
| **K** | | | | | | 1.00 | 0.19 | -0.02 | -0.02 | 0.14 | -0.08 |
| **$HCO_3$** | | | | | | | 1.00 | 0.19 | 0.29 | 0.44 | -0.22 |
| **Cl** | | | | | | | | 1.00 | 0.71 | 0.55 | -0.03 |
| **$SO_4$** | | | | | | | | | 1.00 | 0.36 | 0.05 |
| **$NO_3$** | | | | | | | | | | 1.00 | -0.21 |
| **F** | | | | | | | | | | | 1.00 |

**Table-10.10:** Correlation Matrix, Deeper Aquifer-Post-monsoon Season.

| | pH | EC | Na | Ca | Mg | K | $HCO_3$ | Cl | $SO_4$ | $NO_3$ | F |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **pH** | 1.00 | -0.06 | 0.11 | -0.20 | -0.09 | -0.17 | -0.08 | -0.06 | -0.01 | -0.24 | 0.35 |
| **EC** | | 1.00 | 0.89 | 0.24 | 0.78 | -0.18 | 0.16 | 0.88 | 0.86 | -0.11 | -0.17 |
| **Na** | | | 1.00 | 0.31 | 0.72 | 0.02 | 0.24 | 0.77 | 0.87 | 0.06 | 0.04 |
| **Ca** | | | | 1.00 | 0.59 | 0.86 | -0.06 | 0.41 | 0.49 | 0.88 | 0.85 |
| **Mg** | | | | | 1.00 | 0.33 | 0.20 | 0.73 | 0.84 | 0.37 | 0.30 |
| **K** | | | | | | 1.00 | 0.19 | 0.01 | 0.18 | 0.97 | 0.98 |
| **$HCO_3$** | | | | | | | 1.00 | 0.03 | 0.07 | 0.30 | -0.11 |
| **Cl** | | | | | | | | 1.00 | 0.66 | 0.06 | 0.02 |
| **$SO_4$** | | | | | | | | | 1.00 | 0.20 | 0.17 |
| **$NO_3$** | | | | | | | | | | 1.00 | 0.96 |
| **F** | | | | | | | | | | | 1.00 |

### 10.3.3 Suitability of Ground Water for Drinking Purposes:

The prime objective of ground water quality monitoring is to assess its suitability for drinking and irrigation purposes. Ground water samples are classified on the basis of constituents falling below desirable limit (<DL), in the range of desirable and maximum permissible limit (DL-MPL) and above maximum permissible limit (MPL) for drinking water purpose. Results from shallow and deeper aquifers for pre and post-monsoon seasons are presented graphically in **Figure-10.5 & 10.6** and **Figure-10.7 & 10.8** respectively.

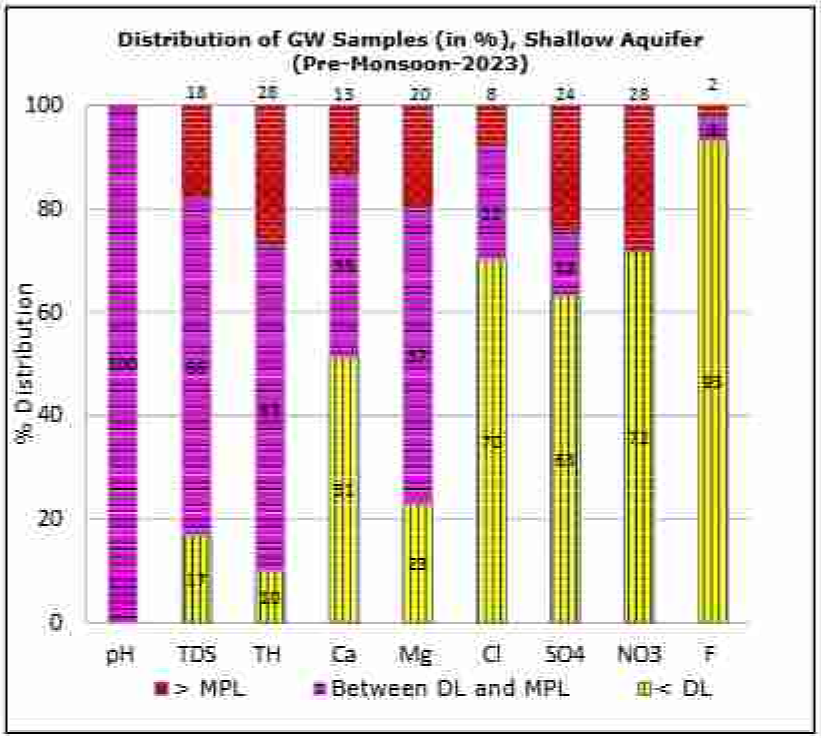



**Figure-10.5:** Distribution of GW Samples (Pre-23), Shallow aquifer.

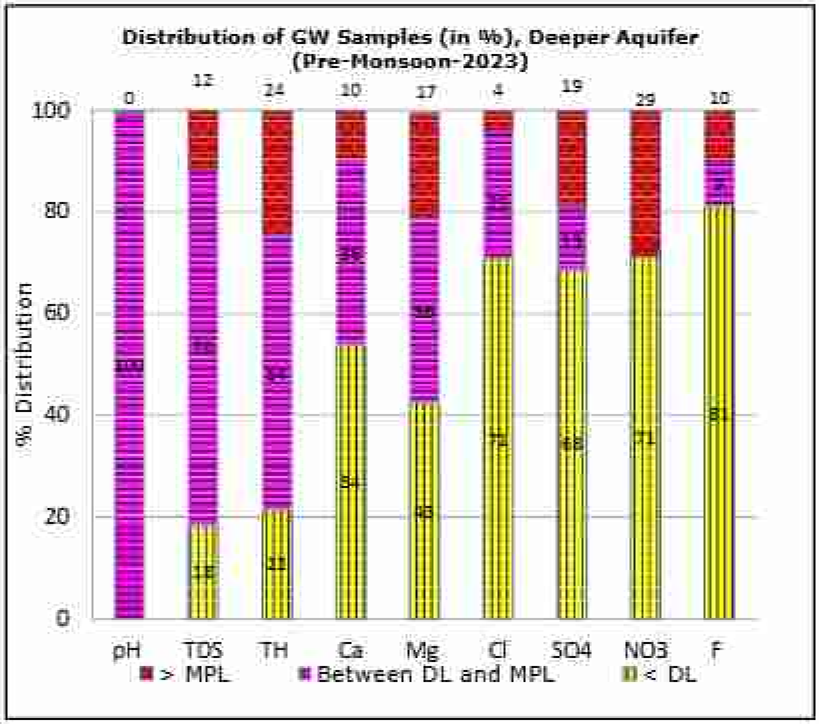



**Figure-10.6:** Distribution of GW Samples (Pre-23), Deeper aquifer.

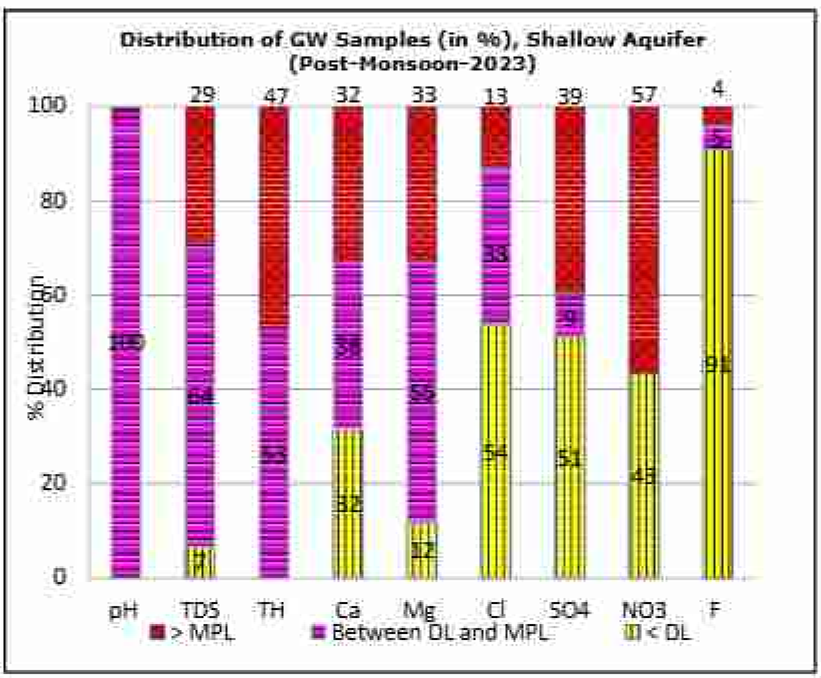



**Figure-10.7:** Distribution of GW Samples (Post-23), Shallow aquifer.

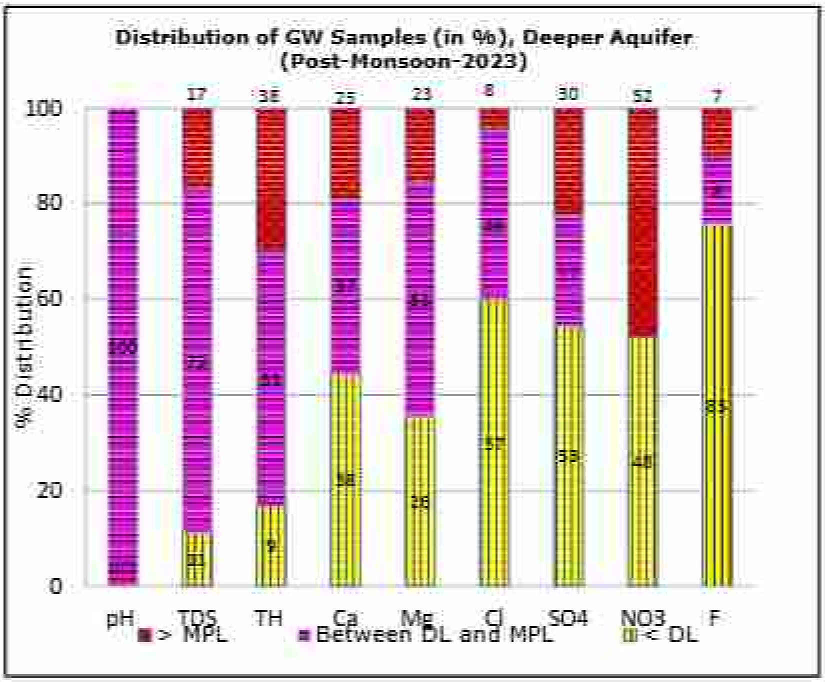



**Figure-10.8:** Distribution of GW Samples (Post-23), Deeper aquifer.

From **Table-10.1**, it is observed that in shallow aquifers, during pre-monsoon season, TH in 28%, Ca in 13%, Mg in 20%, Cl in 8%, $SO_4$ in 24%, $NO_3$ in 28% and F in 2% samples is beyond maximum permissible limits of BIS. From **Table-10.2**, it is observed that in deeper aquifers, during pre-monsoon season, TH in 24%, Ca in 10%, Mg in 17%, Cl in 4%, $SO_4$ in 19%, $NO_3$ in 29% and F in 10% samples is beyond maximum permissible limits of BIS. From **Table-10.3**, it is observed that in shallow aquifers, during post-monsoon season, TH in 47%, Ca in 32%, Mg in 33%, Cl in 13%, $SO_4$ in 39%, $NO_3$ in 57% and F in 4% samples is beyond maximum permissible limits of BIS. From **Table-10.4**, it is observed that in deeper aquifers, during post-monsoon season, total hardness in 38%, Ca in 25%, Mg in 23%, Cl in 8%, $SO_4$ in 30%, $NO_3$ in 52% and F in 7% samples, is beyond maximum permissible limits of BIS.

From results it is observed that during pre-monsoon season fluoride concentration is more in deeper aquifers as compared to shallow aquifers in both seasons. It is also observed that nitrate concentration increased during post-monsoon season by 100% in shallow aquifer and by 80% in deeper aquifers.

### 10.3.4 Suitability of Ground Water for Irrigation Purposes:

Chemical quality of ground water is to be evaluated for irrigation, a poor-quality may cause salinity, specific ion toxicity or infiltration problem in soils and such effect of irrigation may adversely affect crop production.

**Suitability from Shallow and Deeper aquifers:**

**Based on USSL Diagram:** The data of pre and post-monsoon season from shallow and deeper aquifer is plotted on USSL diagram in **Figure-10.9a-b & 10.10a-b** respectively and given in **Table-10.11**. Ground water from shallow aquifers during pre-monsoon season falls in 7 classes *viz.* $C_2$-$S_1$, $C_3$-$S_1$, $C_3$-$S_2$, $C_4$-$S_1$, $C_4$-$S_2$, $C_4$-$S_3$ and $C_4$-$S_4$. About 63% samples fall in $C_3$-$S_1$ type, 13% in $C_2$-$S_1$ type and rest in other classes. During post-monsoon season falls in 5 classes *viz.* $C_2$-$S_1$, $C_3$-$S_1$, $C_3$-$S_2$, $C_4$-$S_1$ and $C_4$-$S_2$ Classes. About 66% of ground water samples falls in $C_3$-$S_1$ type and rest in other classes. Data from deeper aquifers, during falls in 8 classes *viz.* $C_2$-$S_1$, $C_3$-$S_1$, $C_3$-$S_2$, $C_3$-$S_3$, $C_4$-$S_1$, $C_4$-$S_2$, $C_4$-$S_3$ and $C_4$-$S_4$. About 57 % samples fall in $C_3$-$S_1$ type, 17 % in $C_2$-$S_1$ type and rest in other classes. During post-monsoon season it falls in 7 classes *viz.* $C_2$-$S_1$, $C_3$-$S_1$, $C_3$-$S_2$, $C_4$-$S_1$, $C_4$-$S_2$, $C_4$-$S_3$ and $C_4$-$S_4$ Classes. About 59 % of ground water samples falls in $C_3$-$S_1$ type, 13% in $C_4$-$S_2$ and rest in other classes.

**Table-10.11:** Distribution of ground water samples (%) for irrigation.

| Aquifer | ***Distribution nos. (in %)*** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | $C_2$-$S_1$ | $C_3$-$S_1$ | $C_3$-$S_2$ | $Cn_3$-$S_3$ | $C_4$-$S_1$ | $C_4$- $S_2$ | $C_4$- $S_3$ | $C_4$- $S_4$ |
| Shallow-Pre | 27(13) | 127(63) | 11(5) | - | 16(8) | 13(6) | 6(3) | 1(0.5) |
| Shallow-Post | 4(5) | 50(66) | 2(3) | - | 10(13) | 10(13) | - | - |
| Deeper-Pre | 38(17) | 126(57) | 21(9) | 1(0.4) | 13(6) | 21 (9) | 2(1) | 1(0.4) |
| Deeper-Post | 14(8) | 98(59) | 12(7) | - | 18(11) | 22(13) | 1(1) | 1(1) |

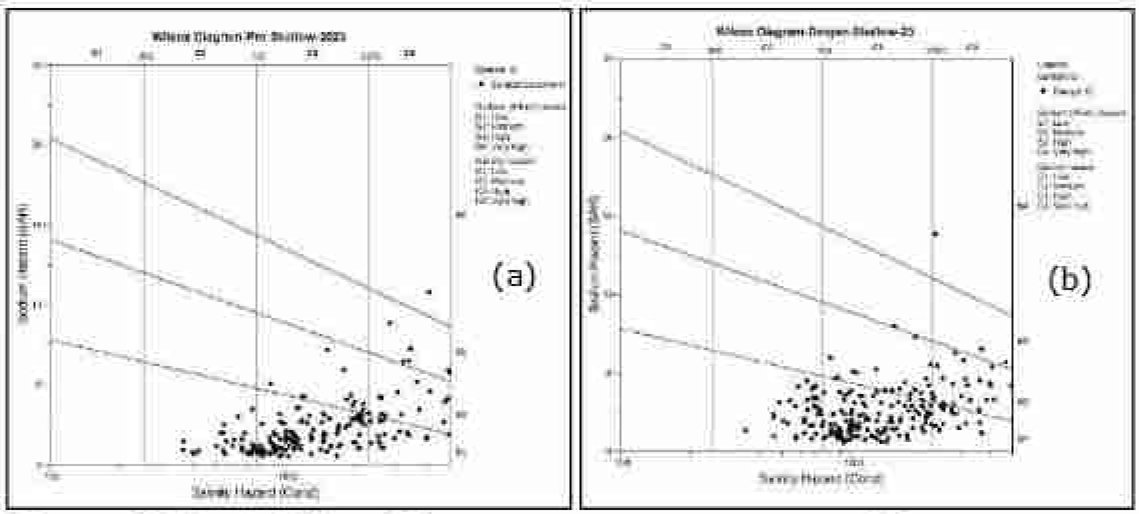


**Figure-10.9a-b:** Wilcox Diagram, pre-monsoon season-23.

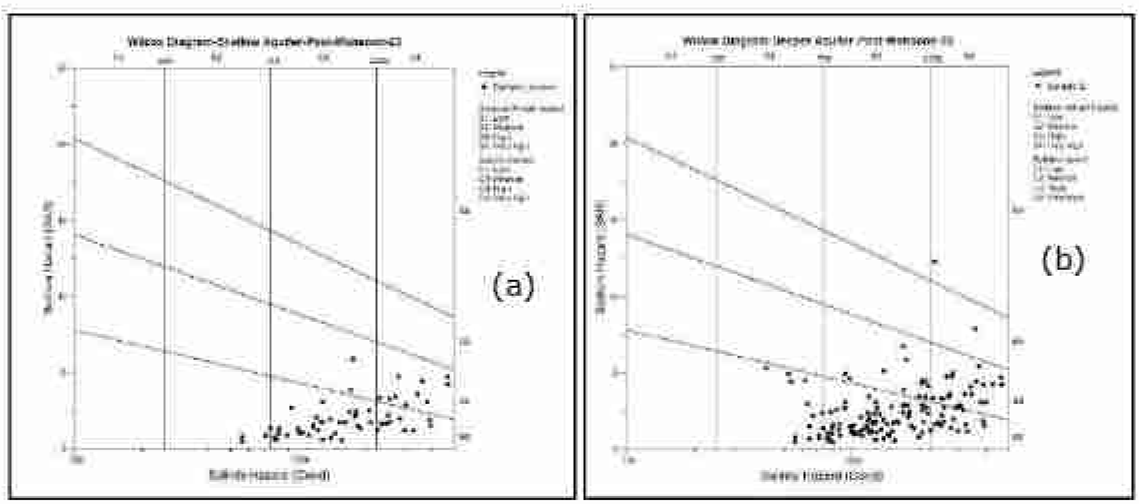


**Figure-10.10a-b:** Wilcox Diagram, post-monsoon season-23.

**Based on Residual Sodium Carbonate (RSC):**

The RSC is defined as the excess of carbonate and bicarbonate amount over the alkaline earths ($Ca^{2+}$ and $Mg^{2+}$). Use of RSC beyond permissible limit (> 2.5) adversely affects irrigation (Eaton, 1950). The tendency of $Ca^{2+}$ and $Mg^{2+}$ to precipitate, as a result, soil becomes more concentrated, because of evaporation and plant transpiration, and gets fixed in soil by the process of base exchange, thereby decreasing the soil permeability. The potential amount of RSC may be computed in epm as

$$(Na_2CO_3) = (CO_3^{--} + HCO_3^{-}) - (Ca^{2+} + Mg^{2+})$$

Residual Sodium Carbonate is calculated from above equation and is summarised in **Table-10.12**. Perusal of table-12, reveals that, majority of ground water samples from both shallow and deeper aquifer during pre as well as post-monsoon season falls in safe category (89 to 96%), followed by in marginal classes (3 to 8%). About 8% & 3% samples from deeper aquifer during pre and post-monsoon season respectively falls under not suitable category.

**Table-10.12:** Classification of ground water based on RSC.

| Range of RSC | Category | No of samples and % (pre-monsoon) | | No of samples and % (post-monsoon) | |
|---|---|---|---|---|---|
| | | Shallow | Deeper | Shallow | Deeper |
| <1.25 | Safe | 178 (89%) | 188 (84%) | 73 (96%) | 148 (89%) |
| > 1.25 to < 2.50 | Marginal | 16 (8%) | 18 (8%) | 2 (3%) | 13 (8%) |
| > 2.50 | Not Suitable | 7 (3%) | 17 (8%) | 1 (1%) | 5 (3%) |

**Based on Percent of Sodium (% Na):**

Suitability of ground water for irrigation purposes is assessed by using percent of sodium (% Na) in ground water (Wilcox, 1948, 1955). Excess sodium along with carbonate will lead to formation of alkaline soils. If combined with chloride, saline soils are formed and either of soils will not support growth of crops (Sreedevi, 2004). As per the Indian standards, maximum 60 % of sodium is permissible for irrigation suitability. Sodium percentage in ground water in shallow and deeper aquifers for both seasons is given in **Table-10.13**. The epm values are used to calculate % Na by using the following formula.

$$\% \text{ Na} = \left( \frac{\text{Na}}{\text{Ca}+\text{Mg}+\text{Na}+\text{K}} \right) 100$$

Table-10.13: Classification of ground water (based on % Na).

| **Class** | **% Na** | **Pre-monsoon** | | **Post-monsoon** | |
|---|---|---|---|---|---|
| | | **Shallow (201 nos)** | **Deeper (223 nos)** | **Shallow (76 nos)** | **Deeper (166 nos)** |
| Excellent | < 20 | 16 (8%) | 12 (5%) | 8 (11%) | 12 (7%) |
| Good | 20 to 40 | 102(51%) | 81(36%) | 45(59%) | 82(49%) |
| Permissible | 40 to 60 | 67(33%) | 90(40%) | 21(28%) | 57(34%) |
| Doubtful | 60 to 80 | 16 (8%) | 37 (17%) | 2 (3%) | 12 (7%) |
| Unsuitable | > 80 | 0 | 3 (1%) | 0 | 3 (2%) |

Based on **Table-10.13**, it is observed that majority of samples from both aquifer during pre as well as post-monsoon season falls in good to permissible class. Only 3 samples from deeper aquifers from both seasons fall in unsuitable class.

## 10.4 Demarcation of Safer Aquifers:

From results, it is observed that, out of 2248 $Km^2$ area, during pre and post-monsoon season, about 65% & 79% and 42% and 50% area is identified as safer from shallow and deeper aquifers respectively as EC is < 2250 micro-siemens/cm. Fluoride free areas during pre and post-monsoon season from shallow and deeper aquifers are identified and it is found that 99 % & 98 % and 93% & 95% area fluoride concentration is < 1.5 mg/L. Comparatively fluoride concentration is high in deeper aquifers as compared to shallow aquifers in both seasons.

It is also observed that, nitrate concentration is high in shallow aquifer as compared to deeper aquifer and increased from 28% to 57% and from 29% to 52% in both aquifers during post-monsoon season respectively as compared to pre-monsoon season due to dilution. As it increased.

As for suitability for irrigation is considered, majority of samples (63 % & 66 %) from shallow aquifer and 57% & 59% from deeper aquifer during pre and post-monsoon season respectively falls $C_3$-$S_1$ type. This type of water is mainly found in areas where no proper drainage is developed or where ground water movement is sluggish. In the area, clayey type of soils is dominant where movement is sluggish.

# CHAPTER -11

# GROUND WATER RELATED ISSUES, MANIFESTATIONS & INTERVENTIONS

**11.1 Objectives:** Main objective of this chapter is to identify major ground water related issues based on findings (both quantity and quality related) so that remedial measures can be suggested/adopted to mitigate them.

**11.2 Methodology:** In order to identify ground water related issues in the area, rainfall pattern, depth to water levels, water level trends, aquifer disposition, ground water resource availability, ground water quality, feedback from farmers and field visit to area etc are studied in detail and considered before coming to conclusions and giving recommendations.

**11.3 Results and Discussion:** In study area, following major issues are identified and are discussed below.

a) Low rainfall (Drought Prone Area)
b) Shallow depth of weathering
c) Deep water levels (> 20 m)
d) Long term declining trend in water levels
e) Low yield potential
f) Water scarcity during summer months
g) Source sustainability of existing structures
h) Ground water Quality Issues (Geogenic and Anthropogenic)
i) Water Marketing

**a) Low Rainfall (Drought Prone Area):** Study area receives low rainfall (normal rainfall:527 mm) and falls in rain shadow zone and is part of drought prone area. The rainfall trend over the years is showing declining trend @0.31 mm/year. In the last 25 years (1998-23), it experienced 4 moderate droughts, 3 severe droughts and 13 normal rainfall years and 6 excess rainfall years. It is also observed that about 85-90% rainfall occurs during monsoon season.

**b) Shallow Depth of weathering:** In 71% of geographical area, depth of weathering is very shallow (less than 6 m) and this shallow depth of weathering is not favouring for recharge in shallower depths.

**c) Deep water levels (> 20 m):** In shallow aquifers (< 30 m), deep water levels in the range of > 20 m are observed in ~11 km$^2$ and ~4.5 Km$^2$ area during per and post-monsoon season respectively. In deeper aquifers, very deep-water levels (> 20m) are observed during pre and post-monsoon seasons covering about 90% and 77% of area respectively.

**d) Declining trend in water levels over a decade:** Trend analysis for last 10 years shows that, out of 25 wells, in 5 & 9 wells falling trends @0-0.1 m/yr to >0.2 m and 0-0.1 m/yr to 0.27 m/yr are observed during pre and post-monsoon season respectively. This falling trend is mostly observed in north-eastern north-western part.

**e) Low Yield potential:** As area is occupied by basalt rock, which is compact and hard, where primary porosity is absent and it is developed due to secondary porosity. Yields, in these rocks are mainly controlled by drainage network and the topography of area is mostly flat and ground water flows from central part to all other parts of study area. It is also observed that in 990 Km$^2$ (44% area), low yields (<1 lps) and mostly covering central and western part and in north eastern part.

**f) Water scarcity During Summer Months:** Low rainfall combined with unfavourable hydrogeological conditions, clayey nature of soils, study area faces water scarcity during January to May months. In 19 villages (Out of 123) (Yelvi, Khalati, Ankalagi, Rampur, Waifal, Shegaon, Muchandi, Khandnal, Rajobachiwadi, Utagi, Daudnala, Yeladri, Banali, Asangi Turk, Asangi Jat, Shingnapur, Wajrawad, Karewadi, Konbagi) water scarcity is observed (**Figure-11.1**).

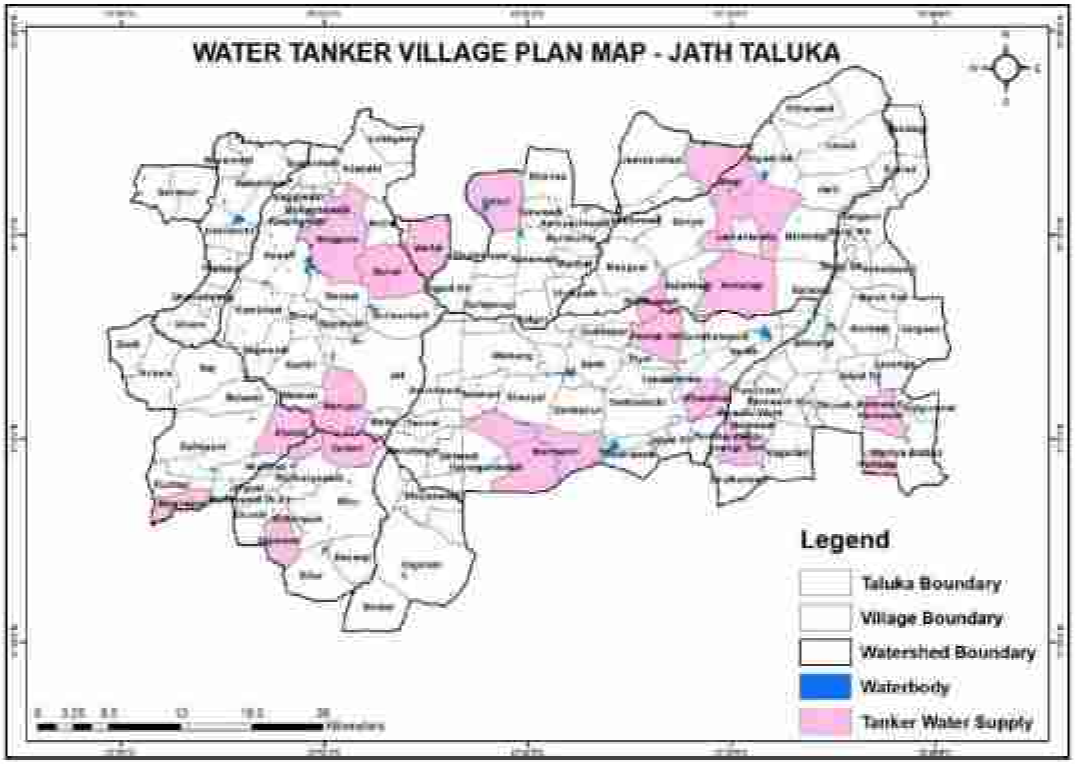



**Figure-11.1:** Tanker Supply Villages, during summer seasons.

**g) Source Sustainability of Existing Ground Water Structures:** The basalt rocks are hydro geologically in-homogeneous in nature. Therefore, yields from wells located in these formations is mostly controlled by drainage network, presence of vesicles and their interconnection with each other and secondary porosity developed due to weathering and fracturing. About 21500 dug wells are identified from google earth map from the area and found that density of irrigation wells is very high (up to 46 wells/km$^2$) (average:10 wells/km$^2$). It is observed that well irrigation density is very high (>20 wells/km$^2$) in northern and western part (**Figure-11.2)**.

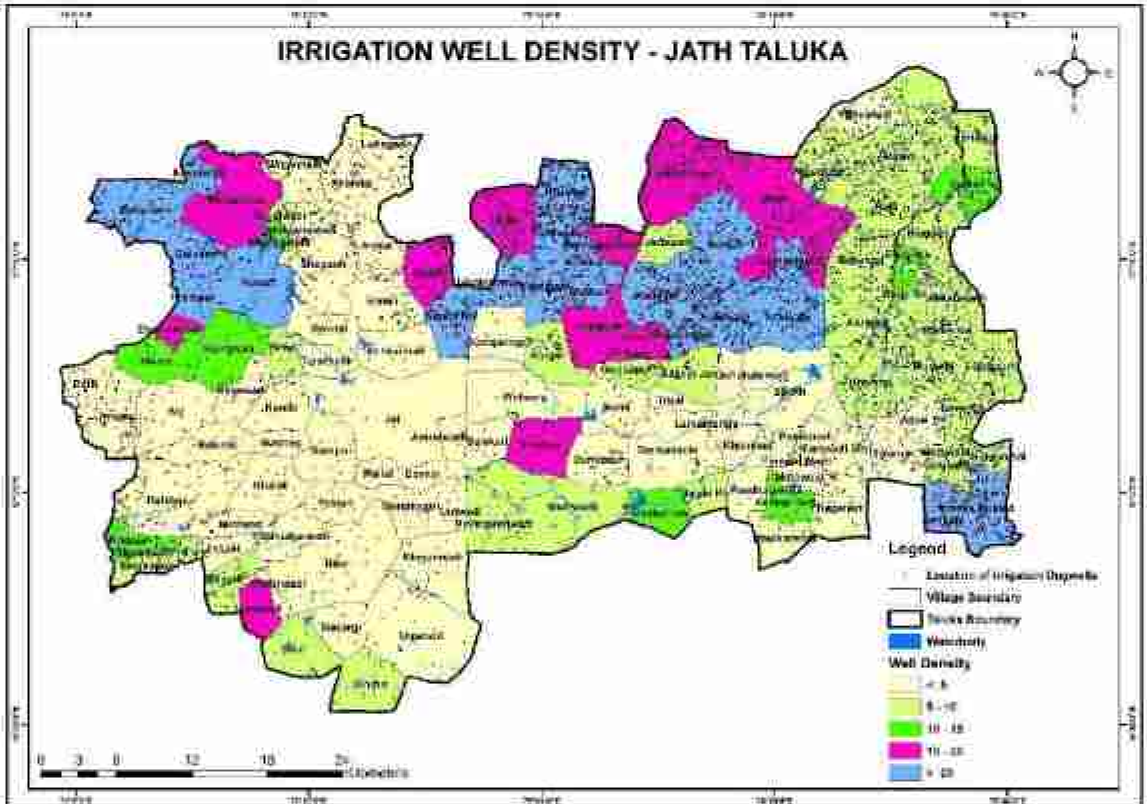



**Figure-11.2:** Irrigation well density, Jath Taluka.

### h) Ground Water Quality Issues (Anthropogenic and Geogenic):

In the area, high electrical conductivity is detected in shallow as well deeper aquifers in both seasons. During pre and post-monsoon season, in shallow aquifer EC is >3000 micro-siemens/cm in ~503 Km² and ~ 903 Km² area respectively. In deeper aquifers also, EC is high (>3000 micro-seimens/cm) as it covered ~228 Km² and ~607 Km² area during pre and post-monsoon season respectively. Nitrate is other major anthropogenic contaminant in ground water as it is found in both aquifers and in both seasons. Comparatively nitrate concentration is high in shallow aquifers as compared to deeper aquifers and during post-monsoon seasons as compared to pre-monsoon seasons. The major cause of higher concentration of nitrate in ground water due to excess utilization of NPK fertilizers and nitrogen fixation by leguminous plants.

Fluoride is main geogenic contaminant in ground water in an area. Results reveals that during pre & post-monsoon season, in shallow aquifer almost 2% & 4% samples are unfit for human consumptions and from deeper aquifers about 10% and 7% samples are unfit for human consumptions. The main reasons for occurrence of high fluoride in ground water is presence of zeolite as secondary filling minerals (in vesicular part of basalt), rock water interaction, longer residence time, high alkalinity and arid conditions.

**i) Water Marketing:** Water marketing is present in Jath town and people are buying water from illegal tanker suppliers for domestic use and buying bottle water from plants for drinking purposes as there is no sufficient supply of potable surface water. Hotel owners are also buying tanker water for meeting their needs. In water scarcity area also, Government agencies have taken over private wells and supplying to people for drinking and domestic use. It is roughly estimated that one tanker on an average supply ~30000 litres/day (10000 x 3 times) and charges Rs 2000/tanker and thus generating net monthly income of Rs.1,80,000/month) (**Figure-11.3**).

**Figure-11.3:** Tanker Water Supply, Jath, during summer seasons.

**11.4 Interventions Recommended to Overcome above Issues**: In order to overcome above issues identified from the area, following recommendations are made.

- Drinking water needs may be met from shallow aquifers from safer areas as identified and discussed in Chapter-10.
- In order to sustain ground water sources for drinking purposes under Jal Jeevan Mission (JJM), check dams with recharge shafts are recommended at the upstream side of sources and at suitable locations sub surface dykes at downside of structures are recommended.
- Hydrofracturing or horizontal bore well drilling is recommended in those wells which have missed the fractures (that lies nearby).
- Efforts may made to provide surface water in those villages which are falling in quality issues area.
- The fluoride rich ground water may be used for other domestic purposes or it can be taken after blending with fluoride free water.
- Defluoridation techniques like activated alumina and low-cost adsorbents and ion exchange is recommended with community involvement in operations and maintenance along with integrated fluorosis mitigations measures as suggested by Godfrey (2007).
- Artificial recharge techniques are to be adopted as various studies have demonstrated that it reduces the $F^-$ in ground water. It is also confirmed from results that during post-monsoon period, F concentration reduces.
- More emphasis may be given to intake of calcium and phosphorous rich food as it helps in reducing the absorption of fluoride by intestine and also reduces the rate of accumulations.
- In high salinity areas, it is recommended to go for salt tolerant crops like sorghum, wheat, chickpea, sesame, Soyabean, sunflower, barley and daylilies a popular and easy to grow flowering plant etc are recommended.

# CHAPTER-12
# SUSTAINABLE GROUND WATER MANAGEMENT PLAN

**12.1 Background**: High dependence on groundwater coupled with absence of augmentation measures has led to a steady fall in water levels and desaturation of weathered zone in some parts of Jath block, raising questions on sustainability of existing groundwater structures, food and drinking water security. The occurrence of fractures in fractured zone are very limited in extent, as the compression in this rock reduces opening of fractures at depth and majority of fractures occur in depth range of 50-100 m depth (34 %). Higher $NO_3^-$ concentrations (> 45 mg/L) in shallow aquifer is due to excess utilization of NPK fertilizers, nitrogen fixation by leguminous plants etc and higher concentration of $F^-$ (>1.5 mg/L) in deeper aquifers is due to presence of zeolites which contains apophyllite, a F bearing mineral as secondary filling, longer residence time, arid conditions and alkaline nature of groundwater.

## 12.2 Management plan

The uneven distribution of groundwater availability and its utilization indicates that a single management strategy cannot be adopted and requires integrated hydrogeological aspects along with socio-economic conditions to develop an appropriate management strategy.

In Jath block, 10176 million cubic meter (mcm) of un saturated volume (below 3 m depth) is available during post-monsoon season of 2023 and having 198.7 mcm of recharge potential (considering specific yield of 2%). The non-commuted surface runoff is 17.03 mcm and this can be utilized for implementing supply side management interventions. In the area water intensive crops like sugarcane is grown in about 7615 ha.

In order to manage the available ground water resources in sustainable manner a combine strategy consisting of 1) Supply side 2) Demand side 3) Institutional and 4) Regulatory measures is recommended.

### 12.2.1 Supply Side Measures

**Ongoing Projects**

**(A) Atal Bhujal Yojana-ABHY:** Atal Bhujal Yojana a central sector scheme (50:50) which aims for sustainable management of ground water with community participation is implemented in the state including Jath block. It envisages people's participation through formation of water budgeting, preparation & implementation of Gram-panchayat-wise water security plans, etc.

Groundwater Surveys and Development Agency (GSDA), working under Water Supply and Sanitation Department (WSSD) of Government of Maharashtra (GoM) is the Project Implementing Agency (PIA) for the scheme in the state. The scheme is implemented in 13 district, 43 blocks covering 1133 villages (including Jath Block). In Jath block, 22 villages located in water stressed area from southern and south-western part are selected (**Figure-12.1).** Under this scheme, various supply side measures along with institutional strengthening and participatory measures are taken up. Total 451 recharge shafts (77 are completed), 6 check dams, 2 KT weirs and 6 percolation tanks are taken up. Village wise structures taken up are given in **Table-12.1**.

**(B) Jal Yuktha Shivar:** Under Jal Yuktha Shivar, Soil and Water Conservation Department, Government of Maharashtra has taken various types of works like water conservation and water harvesting by construction of cement bandharas, renovation of traditional water bodies (desilting of individual farmers wells), drought proofing, in most of the villages. The work was initiated at gram panchayat level having both labour component (411.1 lakh) and material component (18.73 lakh) and sanctioned an amount of Rs 33.74 lakh.

**(C) Jal Jeevan Mission:** Under Jal Jeevan Mission (JJM), most of the villages from Jath block are covered with piped water supply with ground water as source of water. In order to manage the water supply, village water supply committee or water user groups are formed. The quality of water is regularly checked and for this a group consisting of women from the villages are identified. Due to low rainfall and desaturation of shallow aquifers, few sources (mostly dug wells) are getting dried up during peak summer months. Therefore, there is need to strengthen the source with suitable plans like construction of check dams with recharge shafts at upstream side of sources, construction of sub surface dykes at down side of sources and other water conservation measures etc.

Hydrofracturing or horizontal bore well drilling is recommended in those wells which have missed the fractures (that lies nearby).

**(D) To be Taken up**

**Repair, Renovation & Restoration of existing structures (Existing)**

As per District Social and Economic Review 2023, there are 02 medium irrigation projects, 27 small state level and 05 small local level irrigation projects, 41 Kolhapur Type bandharas, 188 percolation tanks and 173 storage tanks in Jath block. As these structures are old, hence they are recommended for desilting to increase their efficiency.

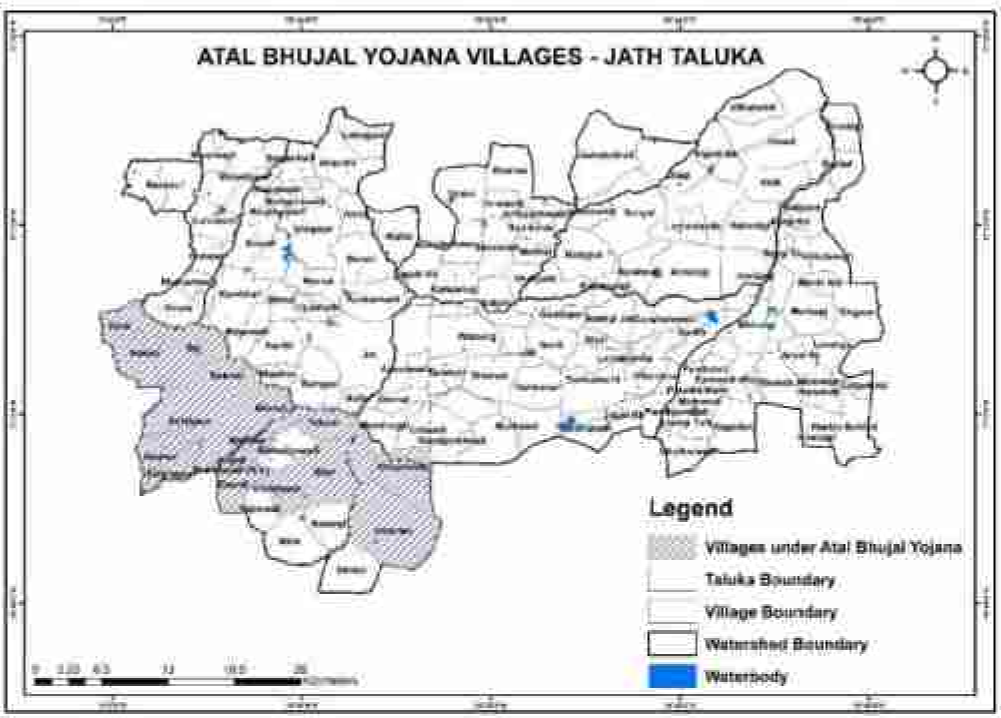



**Figure-12.1**: Map showing villages covered under Atal Bhujal Yojana.

**Table-12.1:** List of villages proposed under ABHY with various structures.

| S. No. | Name | Recharge Shafts | | CD | KT Weirs | Percolation Tanks |
|---|---|---|---|---|---|---|
| | | Proposed | Completed | | | |
| 1 | Yeldari | 7 | | | | |
| 2 | Basrangi | 10 | | | | |
| 3 | Bilur | 22 | | 1 | 1 | 1 |
| 4 | Khilarwadi | 20 | | | | |
| 5 | Salmalgewadi | 19 | 10 | | | |
| 6 | Uncle | 45 | 20 | 1 | | 2 |
| 7 | Baj | 32 | 16 | 1 | | |
| 8 | Belukhi | 8 | | | | |
| 9 | Dorli | 9 | | | | |
| 10 | Daflapur | 40 | 10 | | 1 | |
| 11 | Jirgyal | 18 | | | | 1 |
| 12 | Shelkewadi | 23 | 10 | | | |
| 13 | Vajravaad | 26 | | | | 1 |
| 14 | Mirwad | 25 | 10 | | | 1 |
| 15 | Aikundi | 9 | | | | |
| 16 | Khojanwadi | 26 | | | | |
| 17 | Umrani | 19 | | 2 | | |
| 18 | Sindhur | 29 | | 1 | | |
| 19 | Gugwad | 29 | | | | |
| 20 | Shingnapur | 10 | 1 | | | |
| 21 | Khalati | 16 | | | | |
| 22 | Kudnur | 9 | | | | |
| | **Total** | **451** | **77** | **6** | **2** | **6** |

### Artificial Recharge structures

Construction of 426 artificial recharge structures (ARS) (CD:213 and Recharge Shafts:213) are suggested in 110 villages out of 125 villages by following standard methodology (**Table-12.2**). While formulating the village wise groundwater management plan, an unsaturated volume of aquifer is estimated by multiplying the area with specific yield and unsaturated thickness (post-monsoon water levels below 3 m). 75% probability of normal rainfall is taken (i.e., 0.31 m of 0.41 m), runoff coefficient considered as 0.11%. Potential surface run off is estimated by following standard procedures. On conservative side 25 % run off yield is considered as non-committed yield (after leaving 70% for existing structures and 5% as environmental flows) and actual runoff or runoff generated (after leaving 75%) is considered (whichever is less) for recommending artificial recharge structures.

It is necessary to know the unsaturated aquifer volume available for recharge. The unsaturated volume of aquifer was computed based on the area feasible for recharge, unsaturated depth below 3 m bgl and the specific yield of the aquifer. The total unsaturated volume available for artificial recharge is 10176 MCM. The available surplus runoff of 17.03 mcm can be utilized for artificial recharge through construction of percolation tanks, Check dams and Recharge shafts at suitable sites. This surplus water can be utilized for constructing 213 check dams with equal number of recharge shafts (213) at suitable sites. This intervention should lead to recharge about 12.8 mcm/year. This will reduce stage of ground water extraction from present 63.8 % to 61 %. Initially priority should be given to non-command and water stressed areas, saline and fluoride endemic areas for taking these structures along with water conservation measures, followed by other areas. The location of proposed check dams with recharge shaft is presented in **Figure-12.2** and listed in **Table-12.2**.

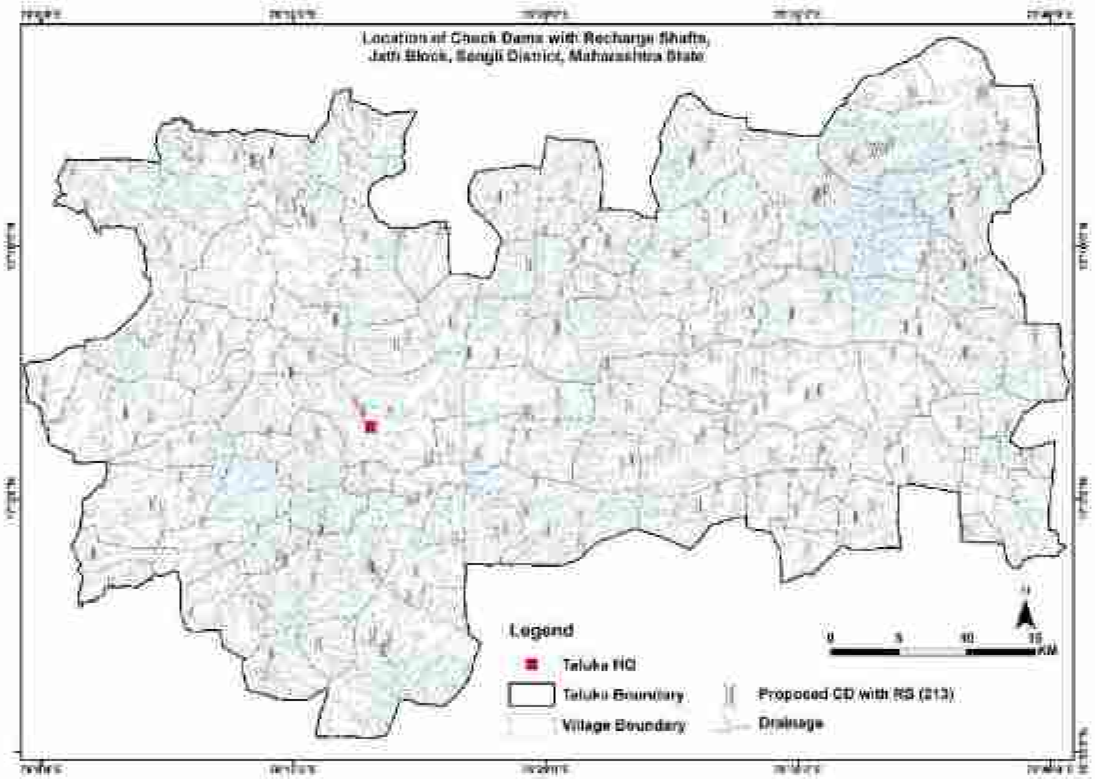



**Figure-12.2:** Location of Proposed Check Dams with RS, Jath Block.

**Table-12.2:** Supply side interventions, proposed in Jath Block.

| Village | Runoff generated | Unsaturated thickness | Volume of unsaturated Zone | Recharge Potential | Runoff available for recharge | CD | RS | Volume of Water expected to be conserved/ recharged @ 75% efficiency |
|---|---|---|---|---|---|---|---|---|
| | (mcm) | (m) | (mcm) | (mcm) | (mcm) | Nos | Nos | (mcm) |
| Achkanhalli | 0.72 | 6.51 | 138.65 | 2.77 | 0.18 | 2 | 2 | 0.14 |
| Akkalawadi | 0.42 | 7.60 | 95.41 | 1.91 | 0.11 | 1 | 1 | 0.08 |
| Ambyachiwadi | 0.23 | 8.90 | 60.95 | 1.22 | 0.06 | 1 | 1 | 0.04 |
| Amrutwadi | 0.22 | 7.80 | 49.58 | 0.99 | 0.05 | 1 | 1 | 0.04 |
| Ankalagi | 1.05 | 2.70 | 83.70 | 1.67 | 0.26 | 3 | 3 | 0.20 |
| Ankale | 0.73 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0.00 |
| Antral | 0.43 | 2.86 | 36.13 | 0.72 | 0.11 | 1 | 1 | 0.08 |
| Asangi Jat | 0.52 | 5.90 | 90.91 | 1.82 | 0.13 | 2 | 2 | 0.10 |
| Asangi Turk | 0.35 | 2.45 | 25.63 | 0.51 | 0.09 | 1 | 1 | 0.07 |
| Avandhi | 0.71 | 3.73 | 78.33 | 1.57 | 0.18 | 2 | 2 | 0.13 |
| Bagalwadi | 0.13 | 4.01 | 14.94 | 0.30 | 0.03 | 0 | 0 | 0.02 |
| Bagewadi | 0.43 | 1.59 | 20.36 | 0.41 | 0.11 | 1 | 1 | 0.08 |
| Baj | 0.91 | 1.30 | 35.10 | 0.70 | 0.23 | 3 | 3 | 0.17 |

| Village | Runoff generated | Unsaturated thickness | Volume of unsaturated Zone | Recharge Potential | Runoff available for recharge | CD | RS | Volume of Water expected to be conserved/ recharged @ 75% efficiency |
|---|---|---|---|---|---|---|---|---|
| Balgaon | 0.61 | 5.40 | 96.79 | 1.94 | 0.15 | 2 | 2 | 0.11 |
| Banali | 0.76 | 1.10 | 24.85 | 0.50 | 0.19 | 2 | 2 | 0.14 |
| Basargi | 0.48 | 1.60 | 22.52 | 0.45 | 0.12 | 1 | 1 | 0.09 |
| Belondgi | 0.78 | 3.50 | 81.00 | 1.62 | 0.20 | 2 | 2 | 0.15 |
| Belunki | 0.60 | 1.50 | 26.46 | 0.53 | 0.15 | 2 | 2 | 0.11 |
| Bevanur | 1.02 | 3.16 | 95.13 | 1.90 | 0.25 | 3 | 3 | 0.19 |
| Bhivargi | 0.91 | 13.70 | 366.71 | 7.33 | 0.23 | 3 | 3 | 0.17 |
| Bilur | 1.80 | 1.55 | 82.27 | 1.65 | 0.45 | 6 | 6 | 0.34 |
| Birnal | 0.31 | 2.09 | 19.11 | 0.38 | 0.08 | 1 | 1 | 0.06 |
| Borgi Bk | 0.30 | 6.00 | 53.66 | 1.07 | 0.08 | 1 | 1 | 0.06 |
| Borgi Kh | 0.22 | 6.50 | 42.47 | 0.85 | 0.06 | 1 | 1 | 0.04 |
| Dafalapur | 1.55 | 1.60 | 73.09 | 1.46 | 0.39 | 5 | 5 | 0.29 |
| Daribadachi | 1.29 | 4.30 | 163.40 | 3.27 | 0.32 | 4 | 4 | 0.24 |
| Darikonur | 0.62 | 3.90 | 71.28 | 1.43 | 0.15 | 2 | 2 | 0.12 |
| Devnal | 0.30 | 4.90 | 43.47 | 0.87 | 0.08 | 1 | 1 | 0.06 |
| Dhavadwadi | 0.18 | 0.00 | 0.00 | 0.00 | 0.00 | 0 | 0 | 0.00 |
| Dhulkarwadi | 0.44 | 1.20 | 15.70 | 0.31 | 0.11 | 1 | 1 | 0.08 |
| Dorli | 0.48 | 0.58 | 8.27 | 0.17 | 0.12 | 2 | 2 | 0.09 |
| Ekundi | 0.45 | 9.00 | 118.41 | 2.37 | 0.11 | 1 | 1 | 0.08 |
| Gholeshwar | 0.43 | 0.50 | 6.37 | 0.13 | 0.11 | 1 | 1 | 0.08 |
| Girgaon | 0.78 | 7.50 | 172.50 | 3.45 | 0.19 | 2 | 2 | 0.15 |
| Gondhalewadi | 0.27 | 2.60 | 20.65 | 0.41 | 0.07 | 1 | 1 | 0.05 |
| Guddapur | 0.32 | 4.20 | 39.79 | 0.80 | 0.08 | 1 | 1 | 0.06 |
| Gugwad | 0.70 | 4.50 | 93.57 | 1.87 | 0.18 | 2 | 2 | 0.13 |
| Gulgunjnal | 0.16 | 4.20 | 19.99 | 0.40 | 0.04 | 1 | 1 | 0.03 |
| Gulvanchi | 0.51 | 2.86 | 42.92 | 0.86 | 0.13 | 2 | 2 | 0.10 |
| Halli | 0.61 | 6.10 | 110.58 | 2.21 | 0.15 | 2 | 2 | 0.11 |
| Jadraboblad | 1.26 | 6.10 | 227.72 | 4.55 | 0.32 | 4 | 4 | 0.24 |
| Jalyal Bk | 0.39 | 6.90 | 78.68 | 1.57 | 0.10 | 1 | 1 | 0.07 |
| Jalyal Kh | 0.30 | 6.90 | 62.00 | 1.24 | 0.08 | 1 | 1 | 0.06 |
| Jat | 2.30 | 7.37 | 501.16 | 10.02 | 0.58 | 7 | 7 | 0.43 |
| Jirgyal | 0.32 | 2.25 | 21.30 | 0.43 | 0.08 | 1 | 1 | 0.06 |
| Kaganari | 0.71 | 5.45 | 114.45 | 2.29 | 0.18 | 2 | 2 | 0.13 |
| Karajagi | 1.02 | 1.60 | 48.38 | 0.97 | 0.26 | 3 | 3 | 0.19 |
| Karajanagi | 0.71 | 1.28 | 26.88 | 0.54 | 0.18 | 2 | 2 | 0.13 |
| Karewadi | 0.37 | 4.10 | 44.87 | 0.90 | 0.09 | 1 | 1 | 0.07 |
| Karewadi (Ko) | 0.36 | 3.70 | 39.08 | 0.78 | 0.09 | 1 | 1 | 0.07 |
| Khairao | 0.66 | 3.50 | 68.28 | 1.37 | 0.16 | 2 | 2 | 0.12 |

| Village | Runoff generated | Unsaturated thickness | Volume of unsaturated Zone | Recharge Potential | Runoff available for recharge | CD | RS | Volume of Water expected to be conserved/ recharged @ 75% efficiency |
|---|---|---|---|---|---|---|---|---|
| Khandnal | 0.40 | 12.40 | 145.08 | 2.90 | 0.10 | 1 | 1 | 0.07 |
| Khojanwadi | 0.63 | 5.50 | 101.75 | 2.03 | 0.16 | 2 | 2 | 0.12 |
| Kolgiri | 0.57 | 3.50 | 58.88 | 1.18 | 0.14 | 2 | 2 | 0.11 |
| Konbagi | 0.16 | 3.60 | 17.28 | 0.35 | 0.04 | 1 | 1 | 0.03 |
| Kudnur | 0.34 | 1.10 | 11.12 | 0.22 | 0.09 | 1 | 1 | 0.06 |
| Kulalwadi | 0.54 | 6.35 | 101.04 | 2.02 | 0.13 | 2 | 2 | 0.10 |
| Kumbhari | 0.85 | 0.64 | 16.00 | 0.32 | 0.21 | 3 | 3 | 0.16 |
| Kunikonur | 0.32 | 4.50 | 42.14 | 0.84 | 0.08 | 1 | 1 | 0.06 |
| Lakdewadi | 0.36 | 1.40 | 15.05 | 0.30 | 0.09 | 1 | 1 | 0.07 |
| Lamantanda | 0.26 | 15.20 | 116.54 | 2.33 | 0.06 | 1 | 1 | 0.05 |
| Lavanga | 0.33 | 0.40 | 3.96 | 0.08 | 0.08 | 1 | 1 | 0.06 |
| Lohagaon | 0.52 | 0.40 | 6.21 | 0.12 | 0.13 | 2 | 2 | 0.10 |
| Madgyal | 0.76 | 5.36 | 120.50 | 2.41 | 0.19 | 2 | 2 | 0.14 |
| Maithal | 0.23 | 0.90 | 6.08 | 0.12 | 0.06 | 1 | 1 | 0.04 |
| Mallal | 0.23 | 3.00 | 20.62 | 0.41 | 0.06 | 1 | 1 | 0.04 |
| Manik Nal | 0.25 | 2.60 | 19.16 | 0.38 | 0.06 | 1 | 1 | 0.05 |
| Mendhegiri | 0.49 | 6.50 | 93.52 | 1.87 | 0.12 | 2 | 2 | 0.09 |
| Mirawad | 0.39 | 2.60 | 30.04 | 0.60 | 0.10 | 1 | 1 | 0.07 |
| Mokashawadi | 0.17 | 5.92 | 30.42 | 0.61 | 0.04 | 1 | 1 | 0.03 |
| Morbagi | 0.64 | 4.25 | 80.88 | 1.62 | 0.16 | 2 | 2 | 0.12 |
| Motewadi | 0.23 | 4.20 | 29.15 | 0.58 | 0.06 | 1 | 1 | 0.04 |
| Muchandi | 1.69 | 3.46 | 173.00 | 3.46 | 0.42 | 5 | 5 | 0.32 |
| Navalwadi | 0.26 | 0.40 | 3.04 | 0.06 | 0.06 | 1 | 1 | 0.05 |
| Nigadi Bk | 0.59 | 2.60 | 45.19 | 0.90 | 0.15 | 2 | 2 | 0.11 |
| Nigadi Kh | 0.59 | 5.32 | 93.34 | 1.87 | 0.15 | 2 | 2 | 0.11 |
| Pandharewadi | 0.39 | 12.40 | 142.09 | 2.84 | 0.10 | 1 | 1 | 0.07 |
| Pandozari | 0.45 | 5.80 | 77.46 | 1.55 | 0.11 | 1 | 1 | 0.08 |
| Rajobawadi | 0.25 | 9.50 | 69.92 | 1.40 | 0.06 | 1 | 1 | 0.05 |
| Rampur | 0.72 | 6.95 | 147.55 | 2.95 | 0.18 | 2 | 2 | 0.13 |
| Ravalgundwadi | 0.61 | 10.07 | 180.36 | 3.61 | 0.15 | 2 | 2 | 0.11 |
| Revnal | 0.52 | 0.91 | 14.11 | 0.28 | 0.13 | 2 | 2 | 0.10 |
| Salekari | 0.41 | 7.21 | 88.15 | 1.76 | 0.10 | 1 | 1 | 0.08 |
| Salmalgewadi | 0.43 | 2.05 | 25.84 | 0.52 | 0.11 | 1 | 1 | 0.08 |
| Sanamadi | 0.56 | 2.10 | 35.00 | 0.70 | 0.14 | 2 | 2 | 0.11 |
| Sankh | 1.69 | 4.50 | 225.00 | 4.50 | 0.42 | 5 | 5 | 0.32 |
| Shedyal | 0.71 | 4.66 | 97.86 | 1.96 | 0.18 | 2 | 2 | 0.13 |
| Shegaon | 1.18 | 1.61 | 56.35 | 1.13 | 0.30 | 4 | 4 | 0.22 |
| Siddhanath | 0.51 | 6.80 | 102.00 | 2.04 | 0.13 | 2 | 2 | 0.10 |

| Village | Runoff generated | Unsaturated thickness | Volume of unsaturated Zone | Recharge Potential | Runoff available for recharge | CD | RS | Volume of Water expected to be conserved/ recharged @ 75% efficiency |
|---|---|---|---|---|---|---|---|---|
| Singanhalli | 0.51 | 2.00 | 30.00 | 0.60 | 0.13 | 2 | 2 | 0.10 |
| Singnapur | 0.31 | 0.96 | 8.75 | 0.18 | 0.08 | 1 | 1 | 0.06 |
| Sonalagi | 0.44 | 9.40 | 123.03 | 2.46 | 0.11 | 1 | 1 | 0.08 |
| Sonyal | 1.22 | 1.60 | 57.60 | 1.15 | 0.30 | 4 | 4 | 0.23 |
| Sordi | 0.61 | 5.25 | 94.50 | 1.89 | 0.15 | 2 | 2 | 0.11 |
| Suslad | 0.51 | 11.00 | 167.22 | 3.34 | 0.13 | 2 | 2 | 0.10 |
| Tikondi | 0.73 | 4.47 | 97.05 | 1.94 | 0.18 | 2 | 2 | 0.14 |
| Tilyal | 0.19 | 0.50 | 2.88 | 0.06 | 0.05 | 1 | 1 | 0.04 |
| Tippehalli | 0.30 | 1.78 | 15.95 | 0.32 | 0.08 | 1 | 1 | 0.06 |
| Tonewadi | 0.30 | 5.60 | 50.40 | 1.01 | 0.08 | 1 | 1 | 0.06 |
| Umadi | 2.03 | 11.50 | 690.00 | 13.80 | 0.51 | 6 | 6 | 0.38 |
| Umarani | 2.03 | 11.55 | 693.00 | 13.86 | 0.51 | 6 | 6 | 0.38 |
| Untwadi | 0.34 | 14.20 | 142.00 | 2.84 | 0.08 | 1 | 1 | 0.06 |
| Utagi | 1.93 | 12.60 | 718.20 | 14.36 | 0.48 | 6 | 6 | 0.36 |
| Vithalwadi | 0.51 | 13.91 | 207.77 | 4.16 | 0.13 | 2 | 2 | 0.09 |
| Waifal | 0.57 | 4.36 | 72.83 | 1.46 | 0.14 | 2 | 2 | 0.11 |
| Walekhindi | 1.32 | 2.48 | 96.72 | 1.93 | 0.33 | 4 | 4 | 0.25 |
| Walsang | 1.08 | 2.40 | 76.80 | 1.54 | 0.27 | 3 | 3 | 0.20 |
| Washan | 0.27 | | 0.00 | 0.00 | 0.07 | 1 | 1 | 0.05 |
| Yelavi | 0.74 | 2.30 | 50.60 | 1.01 | 0.19 | 2 | 2 | 0.14 |
| Yeldari | 0.51 | 1.60 | 24.00 | 0.48 | 0.13 | 2 | 2 | 0.10 |
| **Total** | **68.81** | **504.66** | **9934.43** | **198.69** | **17.03** | **213** | **213** | **12.73** |

### Other Water Conservation Measures Suggested

The villages which are not suitable for artificial recharge structures are suggested to go for water conservation measures like farm ponds, contour bunding, staggered contour trenches etc.

**Farm ponds:** The farm pond (**Figure-12.3**) is ideal water conservation structures, which is constructed in low-lying areas of the farm. The size of farm ponds can be 10 x 10 x 3 m. Total 190 farm ponds are recommended (10 in each village) (in 19 villages excluding as given in **Table-12.2**).


**Figure-12.3:** Farm Pond Constructed in Utagi village.

**Soil Conservation Measures (Contour trenches):** Good soil conservation practices can minimize soil fertility loss from erosion, salinization, or chemical pollution. Soil conservation farming practices stop ground from washing away, which keeps water bodies clean from pollution and sedimentation. Conservation also keeps bare surfaces from cracking and eroding because of water, wind, and too much heat. Contour trenches or staggered contour tranches are the best methods of soil conservations in the area (**Figure-12.4**).

**Figure-12.4:** Contour/Staggered Contour trenches

**Ground Water Development Plan:** No doubt area falls under drought prone area and stage of ground water extraction is 63.8%, there is still scope for further development in few pockets. Still, 17 mcm of ground water can be used for further development (below safe limits of 70%). With this water, additional 1020 dug wells and 170 bore wells can be constructed which can irrigate additional 2615 ha of land under assured irrigation for irrigated dry crops (ID crops).

### 12.2.2 Demand Side Measures

Demand side interventions are proposed to save ground water with higher water use efficient methods of irrigation such as micro irrigation including drip and sprinkler irrigation instead of traditional flooding irrigation methods. Micro irrigation methods minimize water wastage due to evaporation and runoff by providing water to the root zones of plants directly. The precise amount of water is delivered to every plant which promotes uniform growth and also avoids weed growth due to less moisture content in top soil. Micro irrigation systems require less electricity as compared to other systems as it operates at low pressure (2-4 bar). Micro irrigation (especially, drip irrigation) keeps soil moisture continuously at a high level near the root zone, and thus, maintains a low level of salt concentration. Therefore, crops under micro irrigation system are more tolerant to saline water. Studies have demonstrated that, it reduces water consumption on an average by 40-45% (varies from crops to crops). In the area few farmers are already adopting water saving measures in their field (**Figure-12.5**).


**Figure-12.5:** Various demand side measures adopted in Jath Block.

In the block, major water intensive crop is sugarcane (11657 ha) and grape (6426 ha) and few farmers are adopting water saving measures in their farms (**Figure-12.5**), but still others are adopting flooding method of irrigation (particularly to sugarcane crops) which is consuming ~116.57 mcm of ground water for sugarcane and 57.83 mcm for grapes crops (considering 0.01 MCM/ha for sugarcane and 0.009 MCM/ha for grapes) (total usage:174.4 MCM).

If drip irrigation method is adopted for entire crops, then it will save about 56.86 mcm of water (considering 0.0065 mcm/ha) and with this additional 8748 ha of land can be brought under assured irrigation or stage of ground water extraction can be reduced by 11.5 % i.e., from present 63.83 % to 52.33%.

**Other Interventions:**

**Intercropping:** Intercropping has two advantages, first, an intercrop may use resources of light, water, and nutrients more efficiently than single crops planted in separate areas, and this can improve yields and income. Second, crop mixtures frequently have lower pest densities, especially of insect pests. In the area, as intercrop, sowing of soyabean-cotton, soyabean-wheat, sorghum-wheat, sugarcane-wheat etc are suggested (**Figure-12.6**).

**Figure-12.6:** Intercropping in the farm.

**Successful Stories (The Madgyal Model)**

*Madgyal village having a population of 10,000 is located at about 22 kms from Jath town, where average land holding varies between 2-50 acres. It is a challenging task to farmers to make livelihood due to 2 reasons, one as it falls under drought prone area and needs for water management facilities. Due to lack of work, most of farmers migrate to other areas as labours for crane cutting and other activities. With rough estimates, about 25,000 people from 25 villages of this taluka migrate for this type of work annually. To overcome this, a group of 30 farmers involved in* ***"paani foundation"*** *from the village of Madgyal, village, came together by farming* ***"Samatha Farmers group"*** *by pooling 25 acres to grow bajra (pearl millet) and together recorded an unprecedented harvest last season. Pooling land and doing farming together helped these farmers to cut costs and tackle above twin challenge of water scarcity and farmers' migration to* *the sugar belts of the state. The harvest was three times more than the national average (12.43 quintal/hectare) and the farmers have bigger goals for the sowing that begins in June 2023 (**Figure-12.7**). Modern agricultural practices that encompass intensive tillage, and judicious use of water and inputs can improve millet productivity, agriculture experts opine. Delighted to have recorded an unprecedented harvest of 41 quintals (one quintal = 100 kilograms) of pearl millet towards the end of 2022, from an acre (0.4 hectares) of land, Vithal Chopde of Madgyal, is in high spirits and has bigger goals for this season. "We are used to getting, at the most, four to five pothi (sacks) from an acre, a maximum two quintals of bajra. The unmatched harvest in the last season has been a miracle. I plan to increase its cultivation to two acres this year," says Chopde.*

Therefore, it is recommended to go for similar approach in the block.


**Figure-12.7:** Farmers from Madgyal, with their produce (pearl millet).

### 12.2.3 Institutional Measures

**Farmers Feed Back:** In order to get feedback, 38 feed backs were taken from farmers, during field traverses and key well establishment (**Figure-12.8)**. Carrying out this type of activities helps in better understanding of the field related issues and how to overcome these issues.

**Figure-12.8:** Field Hydrogeologists taking Farmers feedback.

**Information, Education and Communication (IEC) Activities**

Under capacity building, one Public Interaction Programs (PIP) was conducted on ground water issues and its management practices at Daflapur village, where 90 participants participated (including women) and one Tier-III training program, where 108 participants participated (including 15 women) at Jath town in collaboration with line department like Agriculture, GSDA WSD, JJM with farmers and other representatives under Rajiv Gandhi National Ground Water Training & Research Institute (RGNGWT & RI) (**Figure-12.9**). The PIP programs are dovetailed with celebrations of Azadi KA Amrit Mahotsav and Mission Life Campaign. They were trained to measure water levels, rainfall and maintaining record of water levels in book from. These programmes have helped the general public to understand the problems more scientifically and likely scenario in future if such practices of ground water management is continued.

**Figure-12.9:** Public Interaction Programs and sharing of reports with District Administrator (Sangli).

**12.2.4 Regulatory measures:** It is recommended to implement following regulatory measures.

- Maintaining a safe distance of 500 meters from drinking source well and new well (as per the Maharashtra Groundwater (regulatory for drinking water Purposes) Act, 1993; Maharashtra Act No. XXVIII of 1993).
- During declaration of water scarcity, under section 4 of the above act, extraction of ground water from well located within 1 km radius should be stopped with prior notice.

- Intermittent pumping of bore wells is recommended through regulatory mechanism to avoid the interference of cone of depression between two productive wells.
- Power supply should be regulated by giving power in 4 hour spells, two times a day in morning and evening hours by concerned department so that pumping of bore well is carried out in phased manner to allow recuperations in an aquifer and increase sustainability of ground water abstraction structures.
- As a mandatory measure, every groundwater user should recharge rainwater through artificial recharge structures in proportionate to the extraction.
- In Jath town and rural areas the sewerage line should be constructed to arrest leaching of nitrate in to ground water.
- A participatory groundwater management (PGWM) approach in sharing of groundwater and monitoring resources on a constant basis along with effective implementation of the existing regulatory measures.
- Subsidy/incentives on cost involved in sharing of groundwater may be given to the farmers involved.
- The other measure includes supplementary calcium and phosphorous rich food to the children in fluoride endemic areas.
- Creating awareness about safe drinking water habits, side effects of high fluoride and nitrate rich groundwater, improving oral hygiene conditions are recommended.

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**Annexure-I**

## DETAILS OF WELL INVENTORY, SHALLOW AQUIFER (DUG WELLS)-2023

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 1 | Achkanhalli | 17.0927 | 75.2088 | 664 | 5.8 | 15 | 6 | 6.8 | 12.1 | 1012 | 30.1 | 11.12 | 1182 | 27.9 |
| 2 | Achkanhalli | 17.0928 | 75.2229 | 664 | 14 | 15 | 6 | 8 | 10.2 | 3364 | 27 | 7.9 | 2760 | 28.2 |
| 3 | Akkalwadi | 17.1244 | 75.6345 | 538 | 8 | 12.5 | 5.9 | | 12.2 | 430 | 29.9 | 11.2 | | |
| 4 | Akkalwadi | 17.1406 | 75.6264 | 519 | | 10 | 6.8 | | 10 | | | 10 | | |
| 5 | Amruthwadi | 17.0371 | 75.2751 | 689 | 4.8 | 20 | 3 | 8.9 | 13.1 | 4989 | 26.8 | 16 | 4342 | 27.5 |
| 6 | Amruthwadi | 17.0401 | 75.2752 | 694 | 4.1 | 30 | 3 | 10.8 | 19.4 | 3264 | 29 | 7.88 | 3462 | 25.6 |
| 7 | Amruthwadi | 17.0345 | 75.2734 | 685 | 6.2 | 20 | 4 | 9 | 9.55 | 4720 | 29.4 | 8.6 | 4876 | 27.1 |
| 8 | Ankalagi | 17.1201 | 75.4965 | 557 | 10 | 6 | 6 | | 6 | | | 4.1 | | |
| 9 | Ankalagi | 17.133 | 75.5253 | 517 | | 4.5 | 4.5 | | 4.5 | | | 3.1 | | |
| 10 | Ankalagi | 17.1532 | 75.5005 | 527 | 7 | 10 | 5.6 | | 10 | | | 10 | | |
| 11 | Ankale | 17.027 | 75.0417 | 703 | 7x7 | 22 | 6.5 | | 3 | 813 | 31.1 | 1 | 838 | 31.1 |
| 12 | Ankale | 17.054 | 75.0165 | 709 | 9 | 15 | 6.5 | | 10.2 | 1478 | 31.7 | 1.5 | 1585 | 28.2 |
| 13 | Antral | 17.1701 | 75.2158 | 611 | 3.8 | 12 | 3 | | 6.3 | 878 | 34.2 | 5.86 | 866 | 29.8 |
| 14 | Asangi | 17.0847 | 75.4377 | 594 | | 6.5 | 8.1 | | 9 | 1066 | 30 | 8.9 | 1119 | 26 |
| 15 | Asangi Turk | 16.998 | 75.4987 | 550 | | 15 | | | 4.2 | 2126 | 39.4 | 2.8 | 1950 | 26 |
| 16 | Asangi Turk | 16.9935 | 75.5095 | 533 | | 15 | | | 9.8 | 2526 | 32.5 | 6.7 | | |
| 17 | Asangi Turk | 16.994 | 75.514 | 464 | | 12 | | | 4.25 | 2574 | 33.8 | 4.2 | | |
| 18 | Avandhi | 17.2136 | 75.2061 | 578 | 10.5 | 20 | 3 | 6.1 | 8.2 | 566 | 32.7 | 6.96 | 522 | 31.6 |
| 19 | Avandhi | 17.2201 | 75.2037 | 572 | 2.8 | 12 | 5 | 6.2 | 7.8 | 1394 | 30 | 6.5 | 1201 | 28.4 |
| 20 | Bagalwadi | 17.1984 | 75.1454 | 553 | 4.5 | 15 | 5 | 9.1 | 11.9 | 2171 | 26.3 | 6.4 | 1862 | 29.8 |
| 21 | Bagalwadi | 17.2017 | 75.1505 | 552 | 12 | 20 | 5 | 8.1 | 10.2 | 6728 | 28 | 7.62 | 2157 | 31.6 |
| 22 | Bagewadi | 17.0762 | 75.1337 | 628 | 6.2 | 14 | 6 | 6.3 | 9.6 | 478 | 31 | 6.92 | 426 | 28.2 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 23 | Bagewadi | 17.0756 | 75.124 | 638 | 4.55 | 10 | 5.5 | | 3.1 | 972 | 32.1 | 2.26 | 828 | 26.8 |
| 24 | Baj | 17.0463 | 75.0618 | 725 | 4.2 | 10.5 | 6.4 | Not seen | 6.4 | 1209 | 35.8 | 3.1 | 1128 | 28.5 |
| 25 | Baj | 17.047 | 75.0753 | 729 | 9 | 14.5 | 12.8 | Not seen | 12.8 | 611 | 30.7 | 5.5 | 673 | 26.3 |
| 26 | Balgaon | 17.1935 | 75.6046 | 483 | 9 | 10 | 5.9 | | 7.2 | 1388 | 30.8 | 8.4 | 5197 | |
| 27 | Banali | 17.1467 | 75.2134 | 626 | 4.2 | 12 | 3 | 8 | 6.2 | 1154 | 29.6 | 5.8 | 1080 | 29.8 |
| 28 | Banali | 17.1414 | 75.2138 | 637 | 8.1 | 18 | 4 | | 5.8 | 710 | 30.8 | 4.65 | 792 | 30.1 |
| 29 | Banali | 17.1438 | 75.2133 | 636 | 3.18 | 14 | 3 | 7.1 | 8.05 | 924 | 31.2 | 3.1 | 715 | 29.1 |
| 30 | Banali | 17.1413 | 75.2159 | 640 | 9 | 18 | 4 | | 3.4 | 886 | 26.8 | 2.9 | 29.3 | 28.3 |
| 31 | Belondgi | 17.1722 | 75.5842 | 490 | | 9 | 6.8 | | 5 | 1226 | 29.4 | 6.5 | 6486 | |
| 32 | Belunki | 17.0395 | 75.0909 | 733 | 5.6 | 12.3 | 4.6 | Not seen | 4.6 | 710 | 32.3 | 3.25 | 619 | 27.7 |
| 33 | Belunki | 17.0355 | 75.0825 | 728 | | 15.5 | 4.5 | | 8.65 | 793 | 29.3 | 2.2 | 923 | 27.3 |
| 34 | Bevanur | 17.2045 | 75.0433 | 578 | 4.15 | 12 | | | 4.5 | 2244 | 32 | 6.16 | 1682 | 29.2 |
| 35 | Bhivargi | 17.0882 | 75.5622 | 509 | | 15 | 7 | | 10 | – | | 7.9 | | |
| 36 | Bhivargi | 17.0629 | 75.5533 | 536 | 10 | 25.5 | 8 | | 25.5 | | | 25.5 | | |
| 37 | Bilur | 16.9357 | 75.1677 | 719 | | 13.5 | 2.5 | 2.5-4 | 6.6 | 1151 | 29.1 | 4.9 | 1236 | 26.6 |
| 38 | Bilur | 16.9538 | 75.1554 | 717 | | 15.5 | 4.5 | | 9.8 | 975 | 32 | 8.5 | 985 | 31 |
| 39 | Bilur | 16.9644 | 75.18 | 732 | | 14.5 | 7.5 | | 10 | 795 | 30.7 | 1.5 | 758 | 27.8 |
| 40 | Bilur | 16.9254 | 75.1891 | 748.31 | | 8.5 | 7.5 | | 4 | 898 | 30.7 | 3.3 | 798 | 28.3 |
| 41 | Birnal | 17.0955 | 75.1505 | 603 | 5.4 | 12 | 8 | 8 | 8 | 1208 | 30.4 | 7.38 | 1180 | 26.2 |
| 42 | Birnal | 17.0928 | 75.1497 | 610 | 6.1 | 12 | 3 | 6.7 | 7.1 | 1572 | 32.1 | 2.8 | 1511 | 27.3 |
| 43 | Borgi Khurd | 17.1356 | 75.5831 | 521 | 8 | 9 | 7.5 | | 9 | | | 9 | | |
| 44 | Borgi Khurd | 17.1368 | 75.5931 | 529 | 8 | 10 | 6.9 | | 10 | | | 10 | | |
| 45 | Dafalapur | 17.0009 | 75.0717 | 724.93 | 3 | 12.85 | Not seen | Not seen | 4.55 | 340 | 29.6 | 3.8 | 802 | 24.3 |
| 46 | Dafalapur | 16.9952 | 75.0444 | 690 | 9.5 | 15.5 | 6.5 | | 7.4 | 332 | 34.4 | 1.2 | 638 | 29.8 |
| 47 | Dafalapur | 16.986 | 75.0474 | 688 | 6 | 12 | 7.8 | Not seen | 7.8 | 671 | 32.9 | 6.5 | 562 | 31.5 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 48 | Dafalapur | 16.9741 | 75.0712 | 705 | 4.5 | 8.5 | 0.5 | 0.5-3.4 | 3.35 | 819 | 31.9 | 3.1 | 786 | 28.9 |
| 49 | Dafalapur | 17.0156 | 75.049 | 706 | 6 | 18 | 3.5 | | 11.7 | 955 | 30.3 | 1.5 | 1276 | 30.1 |
| 50 | Dafalapur | 16.9913 | 75.0379 | 690 | 8 | 13.5 | 8.5 | | 13 | 640 | 34 | 7.7 | 937 | 27.8 |
| 51 | Dafalapur | 16.9857 | 75.0377 | 679 | 6 | 15.5 | 12.5 | | 15.3 | 2933 | 33.5 | 8.45 | 3712 | 28.9 |
| 52 | Daribachiwadi | 17.0305 | 75.4233 | 587 | | 15 | 7 | | 9 | 4260 | 30 | 7.6 | 2460 | 25 |
| 53 | Daribachiwadi | 17.033 | 75.4229 | 598 | | 15 | 6.2 | | 14 | 2176 | 30 | 0 | | |
| 54 | Daribachiwadi | 17.0316 | 75.4246 | 574 | | 10 | 7.1 | | 9 | 2070 | 30 | 7.4 | 1826 | 26 |
| 55 | Daribadachi | 17.0335 | 75.4216 | 564 | 5.1 | 9 | 2 | | 8 | 1880 | 28 | 7.32 | 1812 | 28 |
| 56 | Daribadachi | 17.0431 | 75.4078 | 575 | 4.8 | 15 | 4 | | 9.72 | 3988 | 28 | 8.12 | 4027 | 28.4 |
| 57 | Daribadachi | 17.0214 | 75.4527 | 584 | | 10 | | | 9.5 | 1082 | 28.1 | 6.86 | | |
| 58 | Daribadachi | 17.0191 | 75.4587 | 554 | | 10.8 | | | 6.4 | 1587 | 32.2 | 7.2 | | |
| 59 | Darikonur | 17.0423 | 75.3822 | 577 | 7.1 | 10 | 3 | 7.1 | 8.18 | 2057 | 32.2 | 6.26 | 1950 | 27.2 |
| 60 | Darikonur | 17.036 | 75.3783 | 597 | 4.8 | 12 | 2 | 7.8 | 8.2 | 1154 | 31.4 | 7.19 | 1088 | 28.6 |
| 61 | Darikonur | 17.0244 | 75.3778 | 603 | 4.2 | 12 | 3 | 7.1 | 8.1 | 1090 | 31.9 | 7.3 | 1018 | 26.2 |
| 62 | Devnal | 17.005 | 75.2538 | 697 | | 13 | | | 12.6 | 3278 | 36.3 | 11.2 | 2845 | 32 |
| 63 | Devnal | 17.0014 | 75.2454 | 710 | | 15 | | | 10.8 | 1991 | 29.6 | 4.6 | | |
| 64 | Dhavadwadi | 17.1198 | 75.0705 | 649 | 3.2 | 10 | 3 | | 2.3 | 1098 | 31.2 | 1.6 | 1607 | 27 |
| 65 | Dhavadwadi | 17.1194 | 75.0703 | 624 | 8.1 | 12 | 3 | 5.2 | 4.1 | 1648 | 31.8 | 2.62 | 770 | 25.3 |
| 66 | Dhulkarwadi | 16.9689 | 75.5062 | 550 | | 15 | | | 14.65 | 1722 | 31.2 | 4.2 | | |
| 67 | Dorli | 17.0813 | 75.0034 | 661 | 5.1 | 12 | 4.1 | 6 | 5.2 | 1262 | 31.8 | 4.2 | 1202 | 26.8 |
| 68 | Dorli | 17.0889 | 75.0159 | 673 | 4 | 11.6 | 4 | 6 | 4.1 | 456 | 29.3 | 2.96 | 428 | 28.9 |
| 69 | Ekundi | 16.9274 | 75.0991 | 685 | 3 | 12.5 | 4.5 | | 9.7 | 1643 | 28.7 | 5.5 | 1599 | 28.5 |
| 70 | Ekundi | 16.9261 | 75.1078 | 698 | 7 | 25.5 | 13.5 | | 22.3 | 1011 | 30.6 | 18.5 | 872 | 27.2 |
| 71 | Gholeshwar | 17.1446 | 75.3115 | 634 | | 24 | 5.9 | | 4 | 766 | 30 | 4 | 654 | 25 |
| 72 | Girgaon | 17.0849 | 75.6587 | 553 | 12 | 12 | 7 | | 10.6 | 782 | 27.8 | 9.9 | | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (ºC) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (ºC) |
| 73 | Girgaon | 17.0867 | 75.6585 | 561 | 10 | 15 | 8 | | 12.2 | 432 | 26.9 | 11.1 | | |
| 74 | Goleshwar | 17.1465 | 75.3192 | 602 | 3.8 | 10 | 3 | 6 | 3.1 | 1920 | 28.5 | 4.1 | 2198 | 29.9 |
| 75 | Goleshwar | 17.1411 | 75.3155 | 620 | 3.1 | 12 | 3 | | 3.1 | 801 | 30.1 | 3.01 | 921 | 28.2 |
| 76 | Guddapur | 17.086 | 75.4027 | 590 | | 16 | 8.2 | | 14 | 765 | 30 | 7.2 | 910 | 25 |
| 77 | Gugwad | 16.88 | 75.1455 | 679 | 6 | 10.5 | 9.6 | Not seen | 9.6 | 834 | 30.8 | 7.5 | 631 | 33 |
| 78 | Gulgunjal | 16.9997 | 75.5491 | 548 | | 9 | | | 8.4 | 854 | 31.9 | | | |
| 79 | Gulvanchi | 17.1726 | 75.0827 | 601 | 4.5 | 12 | 3 | 5.7 | 6.1 | 1214 | 32.1 | 5.86 | 1180 | 31.6 |
| 80 | Halli | 17.2124 | 75.6 | 508 | 10 | 10 | 6.8 | | 10 | | | 10 | | |
| 81 | Halli | 17.2028 | 75.5995 | 485 | 2 | 8.2 | 7.1 | | 6.8 | 3602 | 30.2 | 5.3 | | |
| 82 | Halli | 17.1896 | 75.5891 | 512 | 5 | 12 | 4.8 | | 12 | | | 12 | | |
| 83 | Hivre | 17.1006 | 75.0599 | 651 | 3.4 | 12 | 3 | | 3.6 | 1194 | 32.1 | 2.6 | 1307 | 27.2 |
| 84 | Hivre | 17.1 | 75.0627 | 647 | 5.1 | 12 | 5 | | 3.28 | 888 | 32.3 | 3.15 | 901 | 26.7 |
| 85 | Jadraboblad | 17.2206 | 75.4306 | 531 | | 9 | 6 | | 8 | 1458 | 28 | 7.2 | | |
| 86 | Jadraboblad | 17.229 | 75.4379 | 532 | | 5 | 5 | | 5 | | | 5 | | |
| 87 | Jadraboblad | 17.241 | 75.4487 | 548 | | 20 | 5.2 | | 16 | | | 15.1 | | |
| 88 | Jalyal Kh | 16.9946 | 75.4473 | 573 | | 18 | | | 6.6 | | | 7.4 | 1361 | 29 |
| 89 | Jalyal Kh | 16.9968 | 75.4453 | 566 | | 18 | | | 16.4 | 2914 | 37.4 | 12.45 | 1450 | 31 |
| 90 | Jat | 17.0622 | 75.2228 | 744 | 12x12 | 19.8 | 1.8 | 1.8-5.8 | 5.8 | 4048 | 31.5 | 4.5 | 3086 | 30.5 |
| 91 | Jat | 17.0356 | 75.2198 | 737 | 12 | 18.5 | 6.5 | | 11.8 | 871 | 33.2 | 16.25 | 662 | 22.5 |
| 92 | Jirgyal | 16.9578 | 75.1107 | 715 | 6 | 18.9 | 4.5 | 4.5-11.8 | 14.8 | 1024 | 30.4 | 5.25 | 1086 | 27.2 |
| 93 | Kaganari | 16.987 | 75.5504 | 578 | | 10 | | | 9.65 | 1814 | 35.2 | 10.45 | 1656 | |
| 94 | Kaganari | 16.9975 | 75.5493 | 542 | | 25 | | | 16.25 | 1374 | 35.2 | 6.45 | | |
| 95 | Kanthi | 17.061 | 75.1427 | 703 | 8 | 10 | 3.55 | Not seen | 3.55 | 1143 | 30.5 | 1.1 | 1013 | 27.2 |
| 96 | Karajangi | 17.112 | 75.3016 | 706 | | 6.5 | 0.5 | | 4.5 | 801 | 30 | 4 | 807 | 25 |
| 97 | Karajgaon | 17.1188 | 75.5748 | 497 | 10 | 15 | 6.8 | | 5 | 8194 | 32.4 | 4 | 4653 | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 98 | Karajgaon | 17.1152 | 75.5737 | 498 | | 10.2 | 7.6 | | 6.8 | 1217 | 30.4 | 5.2 | 5937 | |
| 99 | Karajnagi | 17.1093 | 75.2952 | 661 | 6.1 | 10 | 1 | 3.1 | 7.6 | 2882 | 28 | 6.26 | 2148 | 29.6 |
| 100 | Karajnagi | 17.1114 | 75.3043 | 662 | 5.4 | 8 | 2 | 2.8 | 4.8 | 5529 | 27.4 | 2.3 | 5887 | 29.2 |
| 101 | Karewadi | 17.0028 | 75.6301 | 548 | | 18 | | | 8.45 | 755 | 33.5 | 4.5 | | |
| 102 | Karewadi | 17.0074 | 75.6212 | 555 | | 15 | | | 10.8 | 504 | 31.9 | | | |
| 103 | Karewadi | 16.9988 | 75.6438 | 599 | | 15 | | | 8.2 | 485 | 28.1 | | | |
| 104 | Kaslingwadi | 17.1823 | 75.1401 | 562 | 4.1 | 12 | 3 | 6 | 5.18 | 1310 | 24.2 | 7.1 | 5220 | 29.4 |
| 105 | Khadnal | 17.0154 | 75.465 | 446 | | 18 | | | 12.45 | 2532 | 29.5 | 10.65 | | |
| 106 | Khairao | 17.1265 | 75.351 | 632 | | 15 | 6 | | 8.5 | 1078 | 30 | 8 | 707 | 27 |
| 107 | Khairao | 17.2187 | 75.3516 | 543 | | 7.8 | 6.1 | | 5 | 547 | 30 | 5 | 990 | 27 |
| 108 | Khalati | 17.0156 | 75.1317 | 764.87 | | 15 | 0.1 | 0.1-9.9 | 9.9 | 529 | 30.2 | 2.8 | 603 | 24.2 |
| 109 | Khalati | 17.0005 | 75.1246 | 739 | 12.5 | 13.3 | 1.5 | 1.5-13 | 13 | 452 | 28.6 | 1.5 | 540 | 28.1 |
| 110 | Khandnal | 17.0289 | 75.4735 | 554 | | 18 | | | 16.56 | 3010 | 32.5 | 13.4 | 3435 | 31 |
| 111 | Khandnal | 17.0305 | 75.4784 | 530 | | 20 | | | 16.3 | 3522 | 34.6 | 17.4 | 3120 | 27 |
| 112 | Kolgiri | 17.1065 | 75.3252 | 670 | 8.7 | 12 | 1 | 6.8 | 7.1 | 1503 | 28.3 | 6.72 | 1280 | 29 |
| 113 | Kolgiri | 17.1051 | 75.3338 | 657 | 5.1 | 12 | 1 | 6 | 6.3 | 2828 | 28.3 | 5.8 | 3577 | 29.1 |
| 114 | Kolgiri | 17.1011 | 75.3434 | 663 | | 9.3 | 6.4 | | 7.3 | 1440 | 28 | 7 | 1590 | 26 |
| 115 | Kontya Boblad | 16.9998 | 75.6408 | 563 | | 12 | | | 10.6 | 807 | 29.4 | | | |
| 116 | Kontya Boblad | 17.0111 | 75.6494 | 606 | | 13 | | | 12.6 | 754 | 29.3 | | | |
| 117 | Kontya Boblad | 16.9992 | 75.6516 | 605 | | 10 | | | 9 | | | | | |
| 118 | Kosari | 17.1523 | 75.1346 | 583 | 4.3 | 10 | 3.5 | | 1.08 | 1104 | 32.4 | 1.02 | 1060 | 27.2 |
| 119 | Kosari | 17.144 | 75.1335 | 580 | 8.2 | 15 | 2 | | 1.6 | 1214 | 31.3 | 1.5 | 1221 | 28.7 |
| 120 | Kudnur | 16.9617 | 75.0355 | 679 | 6 | 12 | 8.9 | | 11 | 2869 | 31.5 | 7.5 | 2929 | 29.4 |
| 121 | Kudnur | 16.9803 | 75.0307 | 671 | 7.5 | 16.8 | 6.8 | | 4 | No sample taken | | 0.75 | 6637 | 28.6 |
| 122 | Kulalwadi | 17.1482 | 75.4807 | 553 | 8 | 20 | 7 | | 13.6 | 662 | 28.4 | 11.5 | | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 123 | Kulalwadi | 17.1331 | 75.4538 | 591 | | 9 | 7.8 | | 8.5 | 592 | 31.4 | 7.2 | | |
| 124 | Kumbhari | 17.1092 | 75.1159 | 617 | 2.5 | 12 | 2 | 7 | 5.2 | 1254 | 30.1 | 3.9 | 1025 | 26.7 |
| 125 | Kumbhari | 17.1098 | 75.1175 | 614 | 2.8 | 12 | 3 | 3.6 | 4.3 | 1200 | 32 | 3.38 | 1042 | 28.2 |
| 126 | Lakdewadi | 17.1732 | 75.4198 | 538 | | 5 | 5 | | 4.5 | 830 | 30.4 | 3.8 | | |
| 127 | Lakdewadi | 17.1742 | 75.4203 | 552 | | 8 | 4.9 | | 5 | 562 | 30 | 5 | 495 | 26 |
| 128 | Lavanga | 17.0554 | 75.6417 | 560 | | 6.3 | 6.3 | | 5.4 | 524 | 28.2 | 4.2 | | |
| 129 | Lavanga | 17.0578 | 75.6378 | 585 | 3 | 8 | 7.6 | | 3.2 | 868 | 29.9 | 2.6 | | |
| 130 | Lohagaon | 17.247 | 75.2133 | 552 | 3.1 | 10 | 3 | 7.2 | 8.2 | 1850 | 29 | 3.5 | 598 | 28.7 |
| 131 | Lohagaon | 17.2484 | 75.2142 | 533 | 2.8 | 12 | 4 | 6 | 6.5 | 3120 | 32.2 | 3.35 | 2292 | 28.7 |
| 132 | Madgyal | 17.1326 | 75.4116 | 606 | | 11 | 6 | | 8 | 2087 | 30 | 8.6 | 1115 | 27 |
| 133 | Maithal | 17.1435 | 75.3655 | 589 | | 7.8 | 1.8 | | 4.2 | 652 | 30 | 3.9 | 642 | 27 |
| 134 | Manik Nal | 17.1094 | 75.6226 | 537 | 2 | 5.6 | 5.6 | | 5.6 | | | 5.6 | | |
| 135 | Mendhegiri | 16.9993 | 75.2398 | 747 | | 12 | | | 11.2 | 1204 | 30.8 | 10.8 | | |
| 136 | Mendhegiri | 16.9921 | 75.2345 | 721 | | 25 | | | 8.6 | 1945 | 31.4 | 8.2 | | |
| 137 | Mirawad | 16.9824 | 75.1255 | 757 | 6.5 | 12.3 | 0.5 | 0.5-9.2 | 9.2 | 307 | 30.7 | 5.6 | 452 | 28.5 |
| 138 | Mokhaswadi | 17.1986 | 75.1652 | 563 | 8.2 | 18 | 3 | 11.1 | 14.4 | 1808 | 32.8 | 8.92 | 2267 | 30.2 |
| 139 | Morbagi | 17.1018 | 75.6057 | 518 | | 7.5 | 7.5 | | 7.5 | | | 7.5 | | |
| 140 | Morbagi | 17.0966 | 75.6088 | 549 | | 7 | 7 | | 7 | | | 7 | | |
| 141 | Motewadi | 17.0095 | 75.5243 | 547 | | 25 | | | 18.4 | 1452 | 35.2 | 7.2 | 1545 | |
| 142 | Muchandi | 16.9821 | 75.335 | 654 | | 13.4 | | | 10.2 | 1696 | 33.5 | 5.3 | | |
| 143 | Muchandi | 16.9835 | 75.3369 | 650 | | 8 | | | 6.5 | | | 4.2 | | |
| 144 | Muchandi | 16.9828 | 75.3372 | 652 | | 15 | | | 13.2 | 1905 | | 5.8 | | |
| 145 | Muchandi | 16.9875 | 75.3501 | 639 | | 12 | | | 8.4 | 2182 | 31.2 | 9.4 | | |
| 146 | Munchandi | 16.9793 | 75.3386 | 613 | | 12 | | | 10.35 | 2136 | 32.2 | 9.8 | 2512 | 31 |
| 147 | Munchandi | 17.0061 | 75.3924 | 602 | | 18 | | | 13.2 | | | 13.8 | 1360 | 28 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 148 | Navalwadi | 17.2208 | 75.0867 | 580 | 5.6 | 12 | | | 7.8 | 1060 | 32 | 3.4 | 810 | 29.4 |
| 149 | Nigadi Budruk | 17.2282 | 75.5154 | 541 | | 7 | 7 | | 5.6 | 2872 | 29 | 4 | 1652 | |
| 150 | Nigadi Budruk 1 | 17.2423 | 75.5302 | 503 | 10 | 9 | 8 | | 9 | | | 8 | | |
| 151 | Nigadi Kh. | 17.1197 | 75.2713 | 669 | 4.7 | 8.5 | 6.2 | | 3.7 | 781 | 30 | 4.8 | 611 | 25 |
| 152 | Nigani Kh | 17.1314 | 75.2661 | 650 | 5.9 | 14 | 3 | 8 | 8.98 | 803 | 28.2 | 7.1 | 872 | 27.7 |
| 153 | Nigani Kh | 17.1363 | 75.2638 | 660 | 7.1 | 15 | 2 | | 12.1 | 773 | 27 | 12.1 | 1096 | 27.8 |
| 154 | Nigani Kh | 17.1069 | 75.2795 | 689 | 9.8 | 15 | 3 | | 11.8 | 1531 | 28.1 | 9.28 | 1665 | 28.6 |
| 155 | Pandharwadi | 17.0076 | 75.4724 | 579 | | 12 | | | 7.2 | 685 | 36.3 | | | |
| 156 | Pandherwadi | 17.0409 | 75.5085 | 522 | | 25 | | | 18.25 | 1756 | 32.4 | 15.4 | 1345 | 29 |
| 157 | Pandozari | 17.044 | 75.5175 | 518 | | 8 | | | 7.24 | 1466 | 32 | 8.8 | 2374 | 31 |
| 158 | Pratapur | 17.1468 | 75.1468 | 615 | 3.1 | 12 | 3 | 5 | 5.8 | 1202 | 31.2 | 2.6 | 826 | 28 |
| 159 | Pratapur | 17.1479 | 75.0767 | 620 | 15.1 | 15 | 3 | | 3.1 | 1210 | 30 | 2.28 | 880 | 26.2 |
| 160 | Raibachiwadi | 17.1058 | 75.4251 | 604 | | 9.5 | 4.2 | | 6.5 | 519 | 30 | 5.4 | 518 | 26 |
| 161 | Rampur | 17.0451 | 75.188 | 730 | | 18.2 | 10 | 10-13.2 | 13.2 | 651 | 29.4 | 9.95 | 793 | 25.3 |
| 162 | Ravalgundwadi | 16.9812 | 75.3023 | 682 | | 18 | | | 15.22 | 6428 | 28.1 | 14.8 | 7015 | 28.5 |
| 163 | Ravalgundwadi | 16.9803 | 75.302 | 680 | | 23.33 | | | 5.2 | 6746 | 31.2 | 5.1 | 2718 | 27 |
| 164 | Ravalgundwadi | 16.9813 | 75.3032 | 674 | | 24 | | | 14.5 | 4905 | 28.1 | 12.3 | 9132 | 29 |
| 165 | Ravalgundwadi | 16.9771 | 75.2836 | 685 | | 30 | | | 24.6 | | | 20.1 | | |
| 166 | Revnal | 17.1213 | 75.1774 | 596 | 9*9 | 10 | 4 | | 2.45 | 7846 | 33.2 | 1.9 | 5202 | 29.6 |
| 167 | Revnal | 17.1208 | 75.1788 | 606 | 5.1 | 12 | 6.3 | 6.9 | 8 | 6622 | 27.3 | 5.92 | 4126 | 27.8 |
| 168 | Salekari ,Patchapur | 17.0333 | 75.2864 | 678 | 5.1 | 20 | 5 | | 9.8 | 7928 | 25.3 | 17.5 | 6556 | 27.2 |
| 169 | Salekari ,Patchapur | 17.0237 | 75.2998 | 669 | 6 | 20 | 3 | 9 | 3.3 | 7765 | 28 | 2.92 | 6252 | 27.3 |
| 170 | Salekari, Patchapur | 17.0444 | 75.3034 | 694 | 4.8 | 20 | 3 | | 14.2 | 1175 | 28.5 | | | |
| 171 | Salmalgewadi | 16.9806 | 75.1531 | 779 | 3 | 15 | Not seen | Not seen | 8.9 | 905 | 32.3 | 5.6 | 652 | 28.5 |
| 172 | Salmalgewadi | 16.9562 | 75.1458 | 723 | 8 | 12.5 | 8.5 | | 9 | 392 | 33.9 | 4.5 | | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 173 | Sankh | 17.0595 | 75.5214 | 530 | 6 | 9 | 4 | | 8.4 | | | 7.9 | 4498 | |
| 174 | Sankh | 17.0666 | 75.504 | 530 | 10 | 12 | lined | | 8.7 | 5974 | 30.1 | 7.1 | | |
| 175 | Sanmadi | 17.1242 | 75.3418 | 631 | 6.2 | 11 | 2 | 6 | 6.2 | 1644 | 28.6 | 5.26 | 1528 | 29.4 |
| 176 | Sanmadi | 17.1444 | 75.3287 | 614 | 3.1 | 12 | 2 | | 6.5 | 542 | 29.7 | 5.26 | 596 | 28.2 |
| 177 | Sanmadi | 17.1439 | 75.3412 | 599 | | 14 | 7 | | 7 | 870 | 30 | 4.8 | 1864 | 25 |
| 178 | Shedyal | 17.0482 | 75.3297 | 656 | 4.1 | 20 | 3 | 7.8 | 12.1 | 885 | 30.6 | 9.92 | 778 | 29.1 |
| 179 | Shedyal | 17.0479 | 75.3311 | 653 | 6.1 | 20 | 2 | 7.6 | 10.18 | 2544 | 31 | 8.96 | 1980 | 27.6 |
| 180 | Shedyal | 17.0463 | 75.3261 | 647 | 8.1 | 12 | 3 | | 8.1 | 4352 | 29.8 | 4.1 | 2421 | 26.7 |
| 181 | Shegaon | 17.1563 | 75.1583 | 571 | 5.7 | 20 | 2 | 5.3 | 6.3 | 1848 | 30.2 | 4.96 | 1840 | 28.1 |
| 182 | Shegaon | 17.1581 | 75.1639 | 579 | 10.8 | 15 | 4 | | 5.8 | 3382 | 31.2 | 4.26 | 2860 | 27.2 |
| 183 | Shelkewadi (N.V.) | 16.9546 | 75.0738 | 696 | 11x11 | 13.5 | 2.5 | | 12.3 | 791 | 30.8 | 11.5 | 1556 | 29.8 |
| 184 | Shelkewadi (N.V.) | 16.9555 | 75.0867 | 697 | | 15.5 | 4.5 | | 12.6 | 830 | 31.9 | 7.8 | 28.5 | 28.6 |
| 185 | Siddhanath | 17.0079 | 75.3965 | 582 | | 14 | | | 10.4 | 696 | 32.7 | 9.8 | 1861 | 30 |
| 186 | Sindur | 16.863 | 75.2152 | 740 | | 12.5 | 1.5 | 1.5-8.5 | 8.5 | 1051 | 28.9 | 2.5 | 1148 | 29.9 |
| 187 | Sindur | 16.8471 | 75.2138 | 707 | | 20 | 4 | Not seen | 4 | 1149 | 32.3 | 2.8 | 1233 | 27.4 |
| 188 | Singanhalli | 17.2269 | 75.1521 | 542 | 5 | 15 | 5 | 7 | 4.5 | 4746 | 27 | 3.96 | 4820 | 28.1 |
| 189 | Singnapur | 16.9454 | 75.0342 | 668 | 6 | 12.5 | 8.5 | | 7.75 | 4757 | 33.4 | 4.5 | 6288 | 27.6 |
| 190 | Sonalgi | 17.2531 | 75.6411 | 472 | 8 | 15 | 7.2 | | 11.6 | 1136 | 29.3 | 9.8 | | |
| 191 | Sonalgi | 17.2535 | 75.6424 | 495 | 10 | 15 | 8.1 | | 15 | | | 15 | | |
| 192 | Sonyal | 17.1552 | 75.445 | 562 | | 19.5 | 7 | | 5.8 | 704 | 28 | 4.6 | | |
| 193 | Soradi | 17.0558 | 75.3908 | 585 | | 11 | 6.2 | | 8 | 791 | 30 | 8 | 722 | 27 |
| 194 | Sordi | 17.0621 | 75.3855 | 601 | 5.1 | 11 | 3 | | 9.1 | 924 | 29 | 8.5 | 1191 | 28.4 |
| 195 | Suslad | 17.2226 | 75.6387 | 496 | 10 | 15 | 7.3 | | 15 | | | 14 | | |
| 196 | Tikondi | 17.0337 | 75.5673 | 509 | | 18 | | | 17.2 | 1080 | 35.7 | 9.45 | | |
| 197 | Tikondi | 17.0305 | 75.5701 | 524 | | 8 | | | 5.2 | 916 | 29.5 | 5.5 | | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 198 | Tilyal | 17.0643 | 75.431 | 593 | | 9 | 5.5 | | 3 | 100 | 30 | 3.5 | 1224 | 26 |
| 199 | Tippehalli | 17.0966 | 75.1807 | 615 | 7.8 | 15 | 2 | 7.5 | 11.2 | 2048 | 29 | 7.4 | 1872 | 28.4 |
| 200 | Tippehalli | 17.0977 | 75.1774 | 610 | 4.5 | 10 | 2 | | 2.3 | 2426 | 24.2 | 2.15 | 2280 | 26.8 |
| 201 | Tonewadi | 17.1876 | 75.3481 | 575 | | 10.3 | 6.5 | | 10.2 | 1568 | 30 | 8.6 | 1587 | 26 |
| 202 | Ugadi | 17.1944 | 75.4982 | 540 | 8 | 12 | 8 | | 12 | | | 12 | | |
| 203 | Ugadi | 17.2027 | 75.5037 | 543 | | 5 | 5 | | 5 | | | 5 | | |
| 204 | Umadi | 17.257 | 75.5911 | 480 | | 15 | 8 | | 15 | | | 15 | | |
| 205 | Umadi | 17.263 | 75.593 | 494 | 6 | 15 | 8.2 | | 11.5 | 4806 | 28 | 10.5 | 2427 | |
| 206 | Umadi | 17.2522 | 75.6127 | 478 | 15 | 18 | 6.2 | | 18 | | | 18 | | |
| 207 | Umarani | 16.9298 | 75.2458 | 687 | | 24 | | | 18 | 1203 | 33.8 | 8.6 | | |
| 208 | Umarani | 16.9018 | 75.2511 | 705 | | 24 | | | 22.4 | 3447 | 35.2 | 20.5 | | |
| 209 | Utwadi | 16.9771 | 75.2664 | 693 | | 18 | | | 17.6 | 2087 | 31.2 | 17.2 | | |
| 210 | Vajrawad | 16.915 | 75.1427 | 687 | 8 | 10 | 0.2 | 0.2-2.62 | 2.62 | 2070 | 33.4 | 1.5 | 1904 | 29.8 |
| 211 | Vittalwadi | 17.2637 | 75.5746 | 504 | | 24 | 6.7 | | 24 | | | 24 | | |
| 212 | Vittalwadi | 17.2668 | 75.5534 | 494 | 7 | 21 | 7.2 | | 12 | 2222 | 32.2 | 9.82 | 3027 | |
| 213 | Waifal | 17.1528 | 75.2534 | 638 | 7.8 | 15 | 6 | 6.3 | 8.15 | 748 | 29 | 7.12 | 740 | 28 |
| 214 | Waifal | 17.1581 | 75.2555 | 636 | 7 | 15 | 4 | 7.8 | 8.28 | 754 | 22.5 | 7.6 | 746 | 28.6 |
| 215 | Walekhindi | 17.2076 | 75.1117 | 558 | 3.8 | 20 | 3 | 7.8 | 9.8 | 1336 | 27 | 8.36 | 12625 | 27.2 |
| 216 | Walekhindi | 17.2058 | 75.1144 | 565 | 6.1 | 10 | | | 3.1 | 798 | 31.2 | 2.6 | 587 | 31 |
| 217 | Walsang | 17.0721 | 75.3514 | 731 | 10.11 | 15.5 | 3.1 | 3.1-7.5 | 7.5 | 1605 | 29 | 5.1 | 1689 | 26.9 |
| 218 | Walsang | 17.0723 | 75.3189 | 743 | 10.11 | 15.5 | 8.85 | Not seen | 8.85 | 3512 | 29.8 | 7.6 | 2568 | 30 |
| 219 | Walsang | 17.0563 | 75.3053 | 748 | 6 | 15 | 4.4 | Not seen | 4.4 | 6945 | 28.6 | 3.5 | 7331 | 27.2 |
| 220 | Washan | 17.0346 | 75.1532 | 777 | 9.1 | 12 | 3.6 | Not seen | 3.6 | 1186 | 32.1 | 1.05 | 719 | 26.2 |
| 221 | Waspeth | 17.1191 | 75.3786 | 648 | | 4.5 | 4.8 | | 2.8 | 993 | 28 | 2.5 | 428 | 27 |
| 222 | Yeldari | 16.9928 | 75.1985 | 791 | | 9 | 5.2 | Not seen | 5.2 | 396 | 32.4 | 3.1 | 673 | 25.7 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-seimens/cm) | Temp (°C) |
| 223 | Yeldari | 16.9887 | 75.1858 | 768 | 11.5 | 15.9 | 5.25 | 5.25-6.7 | 6.7 | 1273 | 32.5 | 4.37 | 1443 | 24.8 |
| 224 | Yeldari | 16.9894 | 75.1893 | 780 | 2.5 | 12.5 | Not seen | Not seen | 8.44 | 1188 | 30.8 | 6.4 | 1399 | 26.3 |
| 225 | Yelvi | 17.1961 | 75.3101 | 575 | | 14 | 6.2 | | 6.4 | 1029 | 30 | 5.6 | 1260 | 26 |
| 226 | Yelvi | 17.2013 | 75.3133 | 584 | | 8 | 6.8 | | 5.4 | 1735 | 30 | 5 | 1255 | 26 |

## Annexure-II

# DETAILS OF WELL INVENTORY, DEEPER AQUIFER (BORE WELLS)-2023

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 1 | Achkanhalli | 17.1760 | 75.3810 | 566 | | 114 | | | 91 | 928 | 30 | | 1133 | 29 |
| 2 | Achkanhalli | 17.095 | 75.2233 | 660 | 0.17 | 100 | 4 | | 9.1 | 4592 | 28 | 7.82 | 4426 | 28.6 |
| 3 | Achkanhalli | 17.0945 | 75.2231 | 660 | 0.17 | 100 | 7 | 40 | 30.8 | 3382 | 26.6 | 26.8 | 3160 | 27.2 |
| 4 | Achkanhalli | 17.0933 | 75.223 | 664 | 0.17 | 100 | 7 | | 29.46 | 3158 | 26.6 | 25.6 | 2680 | 26.8 |
| 5 | Akkalwadi | 17.1285 | 75.6289 | 534 | | 210 | | | 102 | 870 | 26.2 | 90.8 | | |
| 6 | Akkalwadi | 17.1345 | 75.6259 | 524 | | 60 | | | 30 | 2017 | 29.5 | 28.6 | 1906 | |
| 7 | Amruthwadi | 17.0365 | 75.2664 | 697 | 0.17 | 180 | 5 | 20 | 32 | 3021 | 28 | 28.62 | 3018 | 28.1 |
| 8 | Amruthwadi | 17.0373 | 75.275 | 689 | 0.17 | 150 | 5 | 20 | 40.8 | 4028 | 28 | 36.8 | 3626 | 29.8 |
| 9 | Amruthwadi | 17.0447 | 75.2744 | 696 | 0.17 | 85 | 5 | 60 | 35.6 | 1466 | 29 | 29.6 | 1687 | 27.3 |
| 10 | Ankalagi | 17.1301 | 75.4912 | 566 | | 60 | | | 24.6 | 824 | 30.1 | 20.1 | | |
| 11 | Ankalagi | 17.1225 | 75.506 | 525 | | 150 | | | 70 | 2216 | 26.2 | 61.2 | | |
| 12 | Ankalagi | 17.108 | 75.4968 | 550 | | 165 | | | 57 | 962 | 28.5 | 51.4 | | |
| 13 | Ankale | 17.0443 | 75.0231 | 717 | 0.17 | 50 | | | 11.4 | 1043 | 31.5 | 6.5 | 985 | 28.5 |
| 14 | Antral | 17.17 | 75.2166 | 611 | 0.17 | 60 | 5 | 20 | 19.2 | 1060 | 28 | 15.98 | 990 | 26.8 |
| 15 | Antral | 17.1703 | 75.2174 | 615 | 0.17 | 80 | 5 | 22 | 26.8 | 920 | 30.1 | 21.9 | 982 | 28.8 |
| 16 | Asangi | 17.0845 | 75.4377 | 594 | | 137 | | | | 839 | 30 | | 346 | 25 |
| 17 | Avandhi | 17.2134 | 75.2061 | 578 | 0.17 | 80 | 5 | 25 | 17.9 | 458 | 30.8 | 15.2 | 428 | 28.6 |
| 18 | Avandhi | 17.2184 | 75.2033 | 573 | 0.17 | 120 | 6 | 30 | 23.8 | 1006 | 25.6 | 21.8 | 580 | 28.1 |
| 19 | Avandhi | 17.2202 | 75.2036 | 578 | 0.17 | 80 | 5 | 20 | 21.3 | 1142 | 33.8 | 19.6 | 1105 | 26.2 |
| 20 | Avandhi | 17.2204 | 75.2015 | 571 | 0.17 | 60 | 5 | 21 | 20.8 | 1336 | 34 | 18.61 | 1210 | 31.6 |
| 21 | Bagalwadi | 17.1967 | 75.1349 | 578 | 0.17 | 60 | 3 | 30 | 40 | 6570 | 27 | 28.9 | 3157 | 30.3 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 22 | Bagalwadi | 17.1973 | 75.1473 | 555 | 0.17 | 100 | 2 | 33 | 28.2 | 4364 | 29 | 27.8 | 25.61 | 32.9 |
| 23 | Bagewadi | 17.0733 | 75.1245 | 638 | 0.17 | 60 | 6 | | 18.9 | 1200 | 29.1 | 18.2 | 986 | 28.7 |
| 24 | Bagewadi | 17.0724 | 75.1242 | 643 | 0.17 | 80 | 5 | | 14.1 | 630 | 31.3 | 12.12 | 680 | 29.2 |
| 25 | Baj | 17.0448 | 75.0621 | 718 | 0.15 | 120 | | | 1.78 | 531 | 29.8 | 1.51 | 1009 | 28.4 |
| 26 | Baj | 17.0478 | 75.0647 | 719 | 0.17 | 42.5 | | | 4.58 | 601 | 29.8 | 3.1 | 652 | 28.5 |
| 27 | Baj | 17.0477 | 75.0688 | 637 | 0.15 | 60 | | | 7.25 | No sample taken | | 3.7 | 1151 | 27.7 |
| 28 | Balgaon | 17.1925 | 75.6036 | 511 | | 75 | | | 39 | 6040 | 29.6 | 35.2 | 8202 | |
| 29 | Balgaon | 17.1917 | 75.6024 | 511 | | 180 | | | 84 | 3120 | 30 | 81.7 | 4987 | |
| 30 | Banali | 17.1466 | 75.2113 | 621 | 0.17 | 60 | 4 | | 18.9 | 1104 | 32.2 | 16.8 | 638 | 30.3 |
| 31 | Basargi | 16.8997 | 75.1851 | 725.31 | 0.15 | 150 | | | 29.82 | 976 | 35.4 | 23.8 | 1170 | 27.8 |
| 32 | Belondgi | 17.1748 | 75.5854 | 487 | | 180 | | | 54 | 4070 | 29.8 | 46.2 | 2586 | |
| 33 | Belunki | 17.0355 | 75.0829 | 728 | 0.15 | 100 | | | 7.7 | 800 | 29.9 | 6.5 | 758 | 30.2 |
| 34 | Bevanur | 17.2173 | 75.0697 | 591 | 0.17 | 80 | | | 28.9 | 998 | 31 | 22.9 | 962 | 31 |
| 35 | Bhivargi | 17.095 | 75.5653 | 538 | | 135 | | | 42 | 2917 | 31.4 | 38.1 | 2761 | |
| 36 | Bhivargi | 17.0768 | 75.5619 | 525 | | 135 | | | 62 | 2888 | 30.6 | 54.2 | | |
| 37 | Bilur | 16.9462 | 75.178 | 726 | 0.17 | 50 | | | 12.9 | 1280 | 31.4 | 9.45 | 1180 | 28.6 |
| 38 | Bilur | 16.9533 | 75.1594 | 717 | 0.15 | 150 | | | 100 | 1235 | 34.5 | 25.5 | 1181 | 27.7 |
| 39 | Birnal | 17.0978 | 75.1514 | 607 | 0.17 | 110 | 6 | | 28.2 | 3610 | 31.2 | 22.82 | 2032 | 27.1 |
| 40 | Borgi Khurd | 17.1381 | 75.5822 | 521 | | 180 | | | 67 | 3334 | 28.2 | 60.8 | 1938 | |
| 41 | Borgi Khurd | 17.1378 | 75.5869 | 491 | | 210 | | | 98 | 4840 | 28.2 | 91.23 | 965 | |
| 42 | Borgi Khurd | 17.1306 | 75.5964 | 513 | | 580 | | | 67 | 1198 | 29.9 | 60.7 | | |
| 43 | Dafalapur | 17.0004 | 75.0711 | 721.83 | 0.15 | 100 | | | 10.1 | 965 | 28.7 | 8.5 | 865 | 27.5 |
| 44 | Dafalapur | 17.0104 | 75.1065 | 748 | 0.15 | 100 | | | 12.27 | 442 | 35.4 | 11.5 | 552 | 28.9 |
| 45 | Daribachiwadi | 17.033 | 75.4229 | 578 | | 50 | | | | 2138 | 30 | DRY | | |
| 46 | Daribadachi | 17.0201 | 75.4106 | 597 | 0.17 | 180 | 3 | 48 | 37.2 | 974 | 32 | 33.18 | 1056 | 27.1 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 47 | Darikonur | 17.0274 | 75.3702 | 603 | 0.17 | 100 | 4 | 38 | 28.18 | 1401 | 32 | 25.26 | 1160 | 28.1 |
| 48 | Darikonur | 17.0222 | 75.37 | 617 | 0.17 | 80 | 4 | | 23.8 | 590 | 28 | 21.6 | 682 | 29 |
| 49 | Darikonur | 17.0215 | 75.3707 | 617 | 0.17 | 200 | 6 | | 56.2 | 849 | 32 | 42.72 | 720 | 28.6 |
| 50 | Devnal | 17.0223 | 75.2671 | 709 | | 140 | | | 28.35 | 1993 | 30.1 | 23.8 | 1850 | 28.4 |
| 51 | Devnal | 17.0116 | 75.2628 | 705 | | 135 | | | 28.4 | 3510 | 31.2 | 24.3 | 3089 | 28.7 |
| 52 | Devnal | 17.0145 | 75.2389 | 617 | | 140 | | | 31.24 | 1300 | 40.1 | 22.26 | 1256 | 30.1 |
| 53 | Devnal | 17.0026 | 75.2447 | 705 | | 240 | | | 54.45 | 1442 | 28.9 | 23.5 | | |
| 54 | Dhavadwadi | 17.119 | 75.0726 | 624 | 0.17 | 60 | 4 | | 17 | 1047 | 31.7 | 15.8 | 928 | 26.7 |
| 55 | Dhavadwadi | 17.1195 | 75.0724 | 627 | 0.17 | 80 | 4 | 20 | 20.8 | 1044 | 31 | 18.62 | 1020 | 28.9 |
| 56 | Dhulkarwadi | 16.9687 | 75.5071 | 562 | | 120 | | | 50 | 910 | 32.1 | 31.6 | 956 | 31 |
| 57 | Dorli | 17.0801 | 74.9977 | 661 | 0.17 | 60 | 4 | 26 | 20.8 | 1845 | 31.2 | 18.6 | 1378 | 27.8 |
| 58 | Dorli | 17.0799 | 74.9968 | 663 | 0.17 | 60 | 4 | | 28.1 | 1188 | 32.7 | 26 | 687 | 28.1 |
| 59 | Dorli | 17.0794 | 74.9971 | 684 | 0.17 | 100 | 3 | 20 | 30.8 | 1208 | 31.7 | 22.8 | 811 | 28.5 |
| 60 | Ekundi | 16.9286 | 75.1125 | 702 | 0.15 | 50 | | | 100 | 741 | 32.8 | 28.5 | 575 | 26.3 |
| 61 | Ekundi | 16.9245 | 75.1007 | 689 | 0.17 | 130 | | | 100 | 2234 | 31.8 | 83.5 | 6.14 | 27.3 |
| 62 | Ekundi | 16.9381 | 75.0999 | 703 | 0.15 | 300 | | | 100 | 468 | 32.4 | 30.2 | 485 | 30.2 |
| 63 | Gholeshwar | 17.1458 | 75.3119 | 609 | | 64 | | | | 675 | 30 | | 609 | 25 |
| 64 | Girgaon | 17.1022 | 75.6508 | 552 | | 135 | | | 62 | 1394 | 31.4 | 59.3 | | |
| 65 | Goleshwar | 17.1459 | 75.314 | 607 | 0.17 | 200 | 3 | | 32.6 | 1489 | 29 | 28.6 | 1280 | 26.2 |
| 66 | Gugwad | 16.8947 | 75.146 | 683 | 0.15 | 540 | | | 31 | 682 | 35.3 | 26.5 | 1169 | 27.8 |
| 67 | Gulgunjal | 17.0269 | 75.6486 | 590 | | 200 | | | 32.8 | 325 | 31.9 | 34.5 | | |
| 68 | Gulgunjal | 17.027 | 75.66 | 565 | | 150 | | | 11.2 | 784 | 29.4 | 8.4 | | |
| 69 | Gulvanchi | 17.1729 | 75.0846 | 587 | 0.17 | 80 | 3 | 22 | 18.2 | 1210 | 28 | 17.8 | 1362 | 29.2 |
| 70 | Gulvanchi | 17.1714 | 75.0753 | 585 | 0.17 | 70 | 6 | 28 | 17.8 | 1238 | 31.2 | 15.6 | 1201 | 28 |
| 71 | Hivre | 17.1009 | 75.0579 | 647 | 0.17 | 100 | 5 | 26 | 10.2 | 787 | 33.8 | 5.6 | 816 | 27.2 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 72 | Hivre | 17.1003 | 75.0583 | 651 | 0.17 | 150 | 8 | 40 | 22.8 | 790 | 30 | 19.8 | 680 | 28.9 |
| 73 | Jadraboblad | 17.2034 | 75.4232 | 563 | | 84 | | | 30 | 700 | 29.4 | 28.3 | | |
| 74 | Jadraboblad | 17.241 | 75.4487 | 527 | | 250 | | | 100 | 1442 | 27.6 | 98.5 | | |
| 75 | Jat | 17.0457 | 75.2174 | 714.18 | 0.15 | 100 | | | 5.93 | 1196 | 31.6 | 4.5 | 898 | 28.6 |
| 76 | Jat | 17.0768 | 75.22 | 746.79 | 0.15 | 250 | | | 36.4 | 2038 | 31.5 | 8.5 | 1799 | 28.1 |
| 77 | Jat | 17.0533 | 75.2671 | 788.98 | 0.15 | 167 | | | 65 | 2743 | 29.8 | 35.5 | | |
| 78 | Jirgyal | 16.9572 | 75.1062 | 710 | 0.17 | 50 | | | 7.9 | 1161 | 30.6 | 5.1 | 1085 | 27.4 |
| 79 | Kaganari | 16.975 | 75.5518 | 558 | | 180 | | | 45.84 | 746 | 33.5 | 48.6 | 657 | 26 |
| 80 | Kaganari | 17.0039 | 75.549 | 481 | | 100 | | | 33.3 | 2747 | 32.7 | 29.4 | 2340 | 27 |
| 81 | Kaniknour | 17.1654 | 75.3624 | 561 | | 91 | | | | 751 | 30 | | 687 | 26 |
| 82 | Kanthi | 17.06 | 75.1441 | 643 | 0.15 | 100 | | | 8.75 | 600 | 32.7 | 7.6 | 578 | 31.5 |
| 83 | Kanthi | 17.0575 | 75.1276 | 731 | 0.15 | 120 | | | 9.52 | 1072 | 33.5 | 4.9 | 985 | 28.5 |
| 84 | Kanthi | 17.0505 | 75.1476 | 651 | 0.15 | 100 | | | 30.5 | 757 | 32.7 | 22.8 | 856 | 28.9 |
| 85 | Karajangi | 17.112 | 75.3016 | 706 | | 50 | | | | 3168 | 28 | | 2672 | 27 |
| 86 | Karajgaon | 17.1373 | 75.5442 | 517 | | 180 | | | 112 | 1144 | 28.7 | 102.5 | 3028 | |
| 87 | Karajgaon | 17.1303 | 75.5715 | 504 | | 135 | | | 24 | 4292 | 30.4 | 20.2 | | |
| 88 | Karajnagi | 17.109 | 75.2903 | 667 | 0.17 | 70 | 4 | | 36 | 3053 | 28.9 | 24.52 | 3641 | 31 |
| 89 | Karajnagi | 17.1087 | 75.3084 | 669 | 0.17 | 120 | 3 | | 42 | 1914 | 29 | 36.8 | 1760 | 28.2 |
| 90 | Karajnagi | 17.1274 | 75.314 | 635 | 0.17 | 60 | 3 | | 26.1 | 384 | 31.1 | 24.21 | 582 | 26.2 |
| 91 | Karajnagi | 17.1115 | 75.301 | 661 | 0.17 | 110 | 3 | | 30.8 | 4138 | 29 | 29.6 | 3621 | 28.2 |
| 92 | Karewadi | 17.0083 | 75.6153 | 555 | | 180 | | | 28.4 | 1460 | 37.3 | 27.4 | 1237 | 26 |
| 93 | Karewadi | 17.0141 | 75.5176 | 568 | | 200 | | | 27.64 | 1124 | 29.5 | 30.4 | | |
| 94 | Karewadi Tk | 17.0241 | 75.5575 | 530 | | 280 | | | 50 | 1526 | 40.9 | 62.5 | 1245 | 29 |
| 95 | Kasilngwadi | 17.1857 | 75.1399 | 560 | 0.17 | 60 | 4 | 20 | 13.8 | 1407 | 24.7 | 11.72 | 1207 | 26.7 |
| 96 | Kasilngwadi | 17.1803 | 75.1448 | 565 | 0.17 | 100 | 5 | 22 | 23.9 | 3132 | 27.9 | 19.1 | 2862 | 28.7 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 97 | Khadnal | 17.0145 | 75.4665 | 522 | | 200 | | | 50 | 1540 | 31.7 | 33.4 | 1750 | 30 |
| 98 | Khairao | 17.212 | 75.349 | 557 | | 50 | | | 30 | 1639 | 30 | | 835 | 26 |
| 99 | Khalati | 17.0087 | 75.1304 | 758 | 0.15 | 130 | | | 65 | 814 | 29.3 | 36.5 | 957 | 27.1 |
| 100 | Khalati | 16.9985 | 75.1249 | 747 | 0.15 | 80 | | | 65 | 560 | 30.1 | 35 | 452 | 28.5 |
| 101 | Khandnal | 17.0291 | 75.4778 | 453 | | 100 | | | 50 | 956 | 33.7 | 72.8 | 816 | 29 |
| 102 | Khandnal | 17.0392 | 75.4866 | 526 | | 48 | | | 22.24 | 4550 | 31.2 | 18.4 | 4234 | 31 |
| 103 | Khilarwadi | 16.9419 | 75.1396 | 733 | 0.15 | 150 | | | 25.38 | 856 | 32.2 | 7.5 | 895 | 28.9 |
| 104 | Khilarwadi | 16.9416 | 75.1362 | 721 | 0.15 | 130 | | | 26.9 | 914 | 31.9 | 21.5 | 973 | 32.3 |
| 105 | Khojanwadi | 16.9485 | 75.2442 | 712 | | 200 | | | 22.42 | 1936 | 37.2 | 24.4 | 1980 | 30.4 |
| 106 | Khojanwadi | 16.9446 | 75.248 | 709 | | 180 | | | 27.54 | 5072 | 32.2 | 23.36 | 1765 | 32.4 |
| 107 | Khojanwadi | 16.9429 | 75.2562 | 712 | | 260 | | | 42 | 6304 | 29 | 37.8 | 6024 | 30.4 |
| 108 | Kolgiri | 17.1162 | 75.3427 | 633 | 0.17 | 100 | 4 | 48 | 28 | 2004 | 30.1 | 26.8 | 1920 | 28 |
| 109 | Kolgiri | 17.1044 | 75.3371 | 663 | 0.17 | 60 | 4 | | 32.1 | 3472 | 24.5 | 20.36 | 3639 | 31.4 |
| 110 | Kontya Boblad | 16.9834 | 75.6572 | 573 | | 200 | | | 50 | 1198 | 37.5 | 39.4 | 1095 | 27.9 |
| 111 | Kosari | 17.152 | 75.1345 | 583 | 0.17 | 75 | 5 | 35 | 8.1 | 542 | 28 | 6.9 | 502 | 28.1 |
| 112 | Kudnur | 16.9722 | 75.0325 | 684 | 0.15 | 100 | | | 14.1 | No sample | | 12.5 | 1242 | 29.9 |
| 113 | Kudnur | 16.9592 | 75.0357 | 610 | 0.15 | 260 | | | 85 | 1128 | 34.5 | 52.47 | 1615 | 31.5 |
| 114 | Kulalwadi | 17.1365 | 75.4657 | 564 | | 210 | | | 91 | 1088 | 29.2 | 86.3 | 898 | |
| 115 | Kumbhari | 17.1109 | 75.1177 | 613 | 0.17 | 80 | 5 | 40 | 20.8 | 1164 | 31.1 | 19.15 | 1172 | 27.7 |
| 116 | Kumbhari | 17.1113 | 75.1175 | 613 | 0.17 | 60 | 4 | | 26 | 1060 | 33.5 | 22.48 | 920 | 28.6 |
| 117 | Lakdewadi | 17.1805 | 75.42 | 593 | | 105 | | | 18.28 | 468 | 31.4 | 16.7 | | |
| 118 | Lakdewadi | 17.1742 | 75.4203 | 563 | | 50 | | | | 609 | 30 | | 664 | 27 |
| 119 | Lamantada | 17.165 | 75.5083 | 569 | | 210 | | | 18 | 1248 | 26.9 | 18.2 | | |
| 120 | Lamantada | 17.1682 | 75.5256 | 538 | 10 | 120 | | | 72 | 970 | 28.9 | 70.3 | | |
| 121 | Lavanga | 17.0708 | 75.6293 | 558 | | 102 | | | 62 | 746 | 26.2 | 54.52 | | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 122 | Lohagaon | 17.2489 | 75.2119 | 560 | 0.17 | 80 | 6 | 26 | 58 | 1566 | 31.2 | 22.8 | 1407 | 30.2 |
| 123 | Madgyal | 17.1334 | 75.4109 | 604 | | 50 | | | | 1988 | 30 | | 1172 | 26 |
| 124 | Maithal | 17.1438 | 75.365 | 599 | | 50 | | | | 751 | 30 | | 740 | 26 |
| 125 | Mallal | 17.016 | 75.2164 | 795 | 0.15 | 243 | | | 100 | 628 | 29.8 | 45.5 | 651 | 25.3 |
| 126 | Manik Nal | 17.1089 | 75.6168 | 550 | | 180 | | | 24.4 | 876 | 28.2 | 21.56 | 874 | |
| 127 | Manik Nal | 17.1173 | 75.625 | 530 | | 165 | | | 68 | 1092 | 28.2 | 59.6 | | |
| 128 | Mendhegiri | 16.9936 | 75.2412 | 722 | | 85 | | | 30.6 | 1098 | 35.7 | 24.28 | 2529 | 29.4 |
| 129 | Mendhegiri | 16.9645 | 75.2429 | 740 | | 150 | | | 31.3 | 7042 | 39.4 | 30.4 | 5424 | 31.4 |
| 130 | Mendhegiri | 16.9993 | 75.2398 | 700 | | 150 | | | 38 | 1642 | 28.7 | 42.5 | | |
| 131 | Mendhegiri | 16.9967 | 75.2423 | 748 | | 150 | | | 18.54 | 2183 | 31.7 | 27.22 | | |
| 132 | Mendhegiri | 16.9889 | 75.2345 | 725 | | 120 | | | 20.45 | | | 28.5 | | |
| 133 | Mirawad | 16.9747 | 75.1365 | 737 | 0.17 | 50 | | | 21.28 | 681 | 30.3 | 15.5 | 786 | 28.5 |
| 134 | Mirawad | 16.9871 | 75.1194 | 668 | 0.15 | 100 | | | 22.22 | 547 | 30.8 | 3.3 | 676 | 28 |
| 135 | Mirawad | 16.984 | 75.1176 | 744 | 0.15 | 100 | | | 22.5 | 571 | 30.8 | 15.5 | 785 | 28 |
| 136 | Mirawad | 16.9715 | 75.1258 | 737 | 0.15 | 50 | | | 25.2 | 698 | 32 | 14.5 | 685 | 27.5 |
| 137 | Mirawad | 16.9787 | 75.1024 | 727 | 0.15 | 450 | | | 30.5 | 973 | 31.4 | 15.5 | 786 | 28.5 |
| 138 | Mokhaswadi | 17.2029 | 75.1799 | 582 | 0.17 | 70 | 4 | 32 | 24.9 | 1006 | 29 | 5.2 | 1070 | 29.2 |
| 139 | Mokhaswadi | 17.1967 | 75.1658 | 566 | 0.17 | 70 | 4 | 33 | 30.8 | 1586 | 26 | 27.42 | 1680 | 28.3 |
| 140 | Morbagi | 17.1126 | 75.6019 | 513 | | 105 | | | 60.5 | 2238 | 26.2 | 56.3 | 1005 | |
| 141 | Morbagi | 17.0827 | 75.6208 | 547 | | 204 | | | 93 | 1204 | 28.2 | 85.2 | | |
| 142 | Motewadi | 17.0049 | 75.5231 | 591 | | 170 | | | 18.23 | 692 | 38.5 | 16.4 | 690 | 31 |
| 143 | Muchandi | 16.9817 | 75.3032 | 691 | | 100 | | | 32.33 | 1401 | 33.2 | 31.9 | 1256 | 31.4 |
| 144 | Muchandi | 16.979 | 75.3392 | 652 | | 200 | | | 36.4 | 1066 | 31.2 | 41.4 | 2025 | 30.1 |
| 145 | Muchandi | 16.9808 | 75.3533 | 641 | | 68 | | | 50 | 3502 | 41.2 | 5.55 | 2109 | 29.4 |
| 146 | Muchandi | 16.9789 | 75.3368 | 654 | | 170 | | | 63.4 | 1510 | 31.7 | 61.5 | | |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 147 | Muchandi | 16.9973 | 75.3052 | 679 | | 200 | | | 13.3 | 3720 | 33.2 | 16.3 | | |
| 148 | Navalwadi | 17.2241 | 75.0924 | 577 | 0.17 | 200 | | | 80 | 2272 | 30 | 68 | 1968 | 29.2 |
| 149 | Navalwadi | 17.2201 | 75.1 | 576 | 0.17 | 220 | | | 100 | 1094 | 29 | 82 | 926 | 28.6 |
| 150 | Nigadi Budruk | 17.2393 | 75.5318 | 504 | | 210 | | | 15.3 | 2654 | 30.1 | 14.3 | 1427 | |
| 151 | Nigadi Budruk | 17.2383 | 75.5433 | 515 | | 180 | | | 30.5 | 3824 | 29.5 | 28.6 | 2922 | |
| 152 | Nigadi Kh. | 17.1192 | 75.2716 | 709 | | 76.2 | | | | 949 | 29 | | 1090 | 25 |
| 153 | Nigani Kh | 17.1347 | 75.2644 | 665 | 0.17 | 80 | 3 | 38 | 42.1 | 1076 | 28 | 38.92 | 926 | 28.1 |
| 154 | Nigani Kh | 17.1225 | 75.2698 | 672 | 0.17 | 150 | 4 | | 60.8 | 1143 | 27 | 52.18 | 1280 | 28.2 |
| 155 | Pandharwadi | 17.0048 | 75.4789 | 572 | | 240 | | | 50 | 2234 | 39.4 | 82.4 | 1900 | 27 |
| 156 | Pandzori | 17.0371 | 75.2228 | 452 | | 150 | | | 24.53 | 828 | 32.5 | 27.4 | 756 | 32 |
| 157 | Pandzori | 17.0305 | 75.5286 | 536 | | 180 | | | 26.4 | 1048 | 33.2 | 63.22 | 956 | 28 |
| 158 | Paradhi Wasti | 17.0285 | 75.5223 | 537 | | 168 | | | 42.26 | 3502 | 33.8 | 48.75 | 3105 | 29 |
| 159 | Pratapur | 17.1473 | 75.0753 | 615 | 0.17 | 60 | 3 | 18 | 19.8 | 1112 | 31 | 17.8 | 1020 | 28.1 |
| 160 | Pratapur | 17.1351 | 75.0781 | 624 | 0.17 | 60 | 5 | 30 | 26.8 | 404 | 26 | 23.6 | 596 | 28.6 |
| 161 | Raibachiwadi | 17.0989 | 75.4303 | 596 | | 50 | | | | 590 | 30 | | 887 | 26 |
| 162 | Rampur | 17.045 | 75.1908 | 732 | 0.15 | 100 | | | 6.5 | 784 | 31.2 | 6.15 | | |
| 163 | Rampur | 17.0306 | 75.1759 | 722 | 0.15 | 33 | | | 15.4 | 553 | 30.4 | 13.5 | 432 | 28.9 |
| 164 | Rampur | 17.0449 | 75.1879 | 727.58 | 0.15 | 60 | | | 24 | 630 | 29 | 18.5 | 562 | 28.5 |
| 165 | Rampur | 17.0419 | 75.1792 | 733 | 0.15 | 100 | | | 26.5 | 830 | 30.6 | 18.5 | 992 | 28.7 |
| 166 | Ravalgundwadi | 16.9874 | 75.2867 | 712 | | 330 | | | 40.22 | 1995 | 28.67 | 36.4 | 1901 | 29.2 |
| 167 | Salekari ,Patchapur | 17.0242 | 75.2942 | 674 | 0.17 | 100 | 5 | 22 | 38.78 | 8772 | 28 | 31.68 | | |
| 168 | Salekari, Patchapur | 17.0339 | 75.2845 | 680 | 0.17 | 85 | 5 | 28 | 32.8 | 4080 | 26 | 28.65 | 5458 | 29 |
| 169 | Salekari, Patchapur | 17.029 | 75.296 | 675 | 0.17 | 100 | 6 | | 29.8 | 2203 | 30 | 23.26 | 2115 | 29.8 |
| 170 | Salmalgewadi | 16.9797 | 75.1344 | 725 | 0.17 | 100 | | | 31.48 | No sample | | 28.5 | 785 | 28.5 |
| 171 | Sanamadi | 17.145 | 75.3558 | 588 | | 121 | | | | 780 | 31 | | 821 | 27 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 172 | Sankh | 17.0878 | 75.4981 | 565 | | 150 | | | 45 | 3584 | 29.3 | 42.3 | 2287 | |
| 173 | Sanmadi | 17.1374 | 75.3416 | 604 | 0.17 | 60 | 3 | | 40.2 | 1060 | 28 | 36.18 | 901 | 27.8 |
| 174 | Sanmadi | 17.1594 | 75.3422 | 585 | 0.17 | 100 | 3 | | 28.9 | 961 | 30.5 | 26.16 | 980 | 26.9 |
| 175 | Shedyal | 17.0388 | 75.3226 | 674 | 0.17 | 70 | 3 | | 38.1 | 5257 | 32.1 | 33.86 | 1620 | 27.8 |
| 176 | Shedyal | 17.0476 | 75.3301 | 653 | 0.17 | 150 | 3 | | 49.2 | 1280 | 27 | 46.2 | 1161 | 28.6 |
| 177 | Shedyal | 17.0464 | 75.3268 | 662 | 0.17 | 80 | 3 | | 22.1 | 1129 | 29 | 19.6 | 1269 | 28.1 |
| 178 | Shegaon | 17.1659 | 75.1802 | 582 | 0.17 | 60 | 5 | | 22.6 | 3364 | 27 | 19.2 | 2648 | 26.2 |
| 179 | Shegaon | 17.1656 | 75.1798 | 582 | 0.17 | 100 | 6 | 30 | 28 | 1246 | 31.2 | 25.8 | 1080 | 28.6 |
| 180 | Shegaon | 17.164 | 75.1796 | 588 | 0.17 | 80 | 8 | | 14.2 | 3382 | 27.8 | 11.8 | 2167 | 27.2 |
| 181 | Shegaon | 17.1641 | 75.1785 | 589 | 0.17 | 100 | 8 | | 18.4 | 2058 | 31.4 | 17.6 | 1672 | 26.8 |
| 182 | Shelkewadi (N.V.) | 16.9541 | 75.0831 | 709 | 0.15 | 160 | | | 100 | 610 | 32.4 | 32.5 | 547 | 26.5 |
| 183 | Siddhanath | 16.9877 | 75.4198 | 580 | | 315 | | | 50 | 5324 | 36.3 | 32.4 | 5123 | 30.6 |
| 184 | Siddhanath | 16.988 | 75.419 | 582 | | 270 | | | 50 | 4524 | 36.9 | 27.4 | 3123 | 28.8 |
| 185 | Sindur | 16.8766 | 75.2117 | 741 | 0.15 | 150 | | | 35.6 | 1405 | 30.8 | 23.8 | 1410 | 33.4 |
| 186 | Singanhalli | 17.2273 | 75.1555 | 544 | 0.17 | 60 | 5 | 22 | 29.3 | 5934 | 29.6 | 19.8 | 2573 | 29.3 |
| 187 | Singanhalli | 17.2273 | 75.1579 | 545 | 0.17 | 60 | 5 | 30 | 32.8 | 5358 | 28 | 26.8 | 4282 | 29.1 |
| 188 | Singanhalli | 17.2242 | 75.1541 | 550 | 0.17 | 100 | 5 | 32 | 56.2 | 8690 | 26.6 | 38.2 | 4757 | 30.9 |
| 189 | Sonalgi | 17.2532 | 75.6428 | 475 | | 225 | | | 92 | 1774 | 28.2 | 87.7 | 1821 | |
| 190 | Sonyal | 17.1612 | 75.4653 | 544 | | 90 | | | 42 | 502 | 27.3 | 18 | 527 | |
| 191 | Sonyal | 17.1787 | 75.4495 | 544 | | 150 | | | 62 | | | 55 | | |
| 192 | Sonyal | 17.1612 | 75.4653 | 544 | | 150 | | | 60 | 1134 | 28.2 | 57.3 | | |
| 193 | Soradi | 17.0712 | 75.385 | 606 | | 50 | | | | 575 | 30 | | 533 | 28 |
| 194 | Soradi | 17.0696 | 75.3972 | 627 | | 50 | | | | 1497 | 30 | | 1192 | 27 |
| 195 | Sordi | 17.0503 | 75.3983 | 588 | 0.17 | 200 | 6 | 42 | 62.1 | 1424 | 31.7 | 50.16 | 1280 | 28.1 |
| 196 | Sordi | 17.0633 | 75.3816 | 604 | 0.17 | 150 | 5 | | 42 | 812 | 32 | 36.2 | 916 | 29.2 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (°C) |
| 197 | Suslad | 17.2262 | 75.6245 | 476 | | 195 | | | 62 | 8938 | 30.4 | 55.6 | 4807 | |
| 198 | Suslad | 17.2265 | 75.6257 | 476 | | 195 | | | 63 | 7487 | 29 | 58.9 | 4028 | |
| 199 | Tikondi | 17.0401 | 75.5829 | 509 | | 200 | | | 50 | 1002 | 34.2 | 56.8 | 1180 | 32 |
| 200 | Tikondi | 17.0176 | 75.5956 | 542 | | 220 | | | 50 | 2570 | 36.3 | 68.3 | 2670 | 31 |
| 201 | Tilyal | 17.0631 | 75.4309 | 590 | | 85 | | | | 1014 | 30 | | 922 | 26 |
| 202 | Tippehalli | 17.0964 | 75.1774 | 610 | 0.17 | 100 | 6 | 38 | 12.8 | 2258 | 21.6 | 3.82 | 2121 | 27.7 |
| 203 | Tippehalli | 17.0988 | 75.1679 | 619 | 0.17 | 80 | 6 | 20.4 | 20.6 | 1478 | 26.6 | 19.26 | 1510 | 25.8 |
| 204 | Tonewadi | 17.187 | 75.3482 | 567 | | 76.2 | | | 11 | 1104 | 30 | | | |
| 205 | Ugadi | 17.1865 | 75.5136 | 531 | | 75 | | | 18.2 | 3978 | 30.1 | 15.4 | 2087 | |
| 206 | Ugadi | 17.2158 | 75.5099 | 540 | | 84 | | | 27 | 1474 | 31.2 | 23 | | |
| 207 | Umadi | 17.2483 | 75.5637 | 495 | | 258 | | | 82 | 3318 | 28.8 | 81.6 | 2758 | |
| 208 | Umadi | 17.2384 | 75.5978 | 486 | | 246 | | | 85 | 2016 | 30.1 | 76.9 | 848 | |
| 209 | Umarani | 16.9113 | 75.2499 | 714 | | 200 | | | 17.4 | | | 21.4 | | |
| 210 | Umarani | 16.9032 | 75.2513 | 708 | | 260 | | | 49.2 | 1724 | 30.4 | 43.5 | | |
| 211 | Umarani | 16.9036 | 75.2511 | 710 | | 230 | | | 47.4 | 1513 | 32.7 | 39.5 | | |
| 212 | Umrani | 16.8941 | 75.2538 | 651 | | 250 | | | 50 | 1064 | 35.4 | 62.8 | 1089 | 31.4 |
| 213 | Utwadi | 16.984 | 75.2602 | 755 | | 170 | | | 47.6 | 1860 | 31.9 | 95 | | |
| 214 | Utwadi | 16.9777 | 75.2664 | 705 | | 80 | | | 27.6 | 1945 | 29.3 | 27.29 | | |
| 215 | Utwadi | 16.9772 | 75.2738 | 690 | | 220 | | | 22.6 | 1895 | 30.1 | 24.64 | | |
| 216 | Vajrawad | 16.9071 | 75.1363 | 600 | 0.15 | 100 | | | 26.08 | No sample | | 8.7 | 1181 | 31.3 |
| 217 | Vaspeth | 17.1131 | 75.3997 | 637 | | 213 | | | 3 | 870 | 30 | | | |
| 218 | Vittalwadi | 17.2654 | 75.5645 | 511 | | 30 | | | 15.24 | 2430 | 26.8 | 14.2 | 1987 | |
| 219 | Vittalwadi | 17.2692 | 75.5481 | 500 | | 210 | | | 97 | 708 | 29 | 85.2 | | |
| 220 | Waifal | 17.1588 | 75.254 | 642 | 0.17 | 60 | 5 | | 20.8 | 1054 | 31.2 | 17.8 | 928 | 29.1 |
| 221 | Waifal | 17.1602 | 75.2542 | 630 | 0.17 | 60 | 3 | | 17.9 | 1052 | 30.1 | 15.8 | 1080 | 29 |

| S. No. | Village | Lat | Long | RL (m amsl) | Dia (m) | Depth (m) | Weathering Depth (m) | Fractures Encountered (m bgl) | Pre-monsoon season (May) | | | Post-monsoon season (Nov) | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DTW (m bgl) | EC (micro-siemens/cm) | Temp (ºC) | DTW (m bgl) | EC (micro-siemens/cm) | Temp (ºC) |
| 222 | Waifal | 17.159 | 75.2553 | 635 | 0.17 | 80 | 3 | | 17 | 1154 | 31.2 | 15.2 | 1146 | 30 |
| 223 | Walekhindi | 17.2028 | 75.116 | 567 | 0.17 | 60 | | | 17.5 | 966 | 32.7 | 15.2 | 827 | 28.8 |
| 224 | Walsang | 17.0665 | 75.3351 | 730 | 0.15 | 128 | | | 6.8 | 2064 | 29.9 | 5.5 | 2065 | 27.2 |
| 225 | Walsang | 17.0609 | 75.3157 | 743 | 0.15 | 150 | | | 65 | 2853 | 28.4 | 29.8 | 2129 | 30.1 |
| 226 | Washan | 17.0284 | 75.157 | 792 | 0.15 | 120 | | | 65 | 1083 | 28 | 33.5 | 1093 | 23.8 |
| 227 | Yeldari | 16.9865 | 75.1817 | 793.27 | 0.15 | 100 | | | 45.5 | 975.4 | 30 | 26.5 | | |
| 228 | Yelvi | 17.1898 | 75.3092 | 594 | | 121 | | | 30 | 529 | 31 | | 523 | 27 |
| 229 | Yelvi | 17.1961 | 75.3101 | 575 | | 61 | | | 30.4 | 725 | 30 | | | |

# Annexure-III

Location of Ground Water Samples from Shallow & Deeper Aquifer During Pre-monsoon Season (2023).

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 1 | Achkanhalli | 17.0927 | 75.2088 | 1 | Abulwadi | 17.1760 | 75.3810 |
| 2 | Achkanhalli | 17.0928 | 75.2229 | 2 | Achkanhalli | 17.0950 | 75.2233 |
| 3 | Amruthwadi | 17.0371 | 75.2751 | 3 | Achkanhalli | 17.0945 | 75.2231 |
| 4 | Amruthwadi | 17.0401 | 75.2752 | 4 | Achkanhalli | 17.0933 | 75.2230 |
| 5 | Amruthwadi | 17.0345 | 75.2734 | 5 | Akkalwadi | 17.1285 | 75.6289 |
| 6 | Ankalagi | 17.1532 | 75.5005 | 6 | Akkalwadi | 17.1345 | 75.6259 |
| 7 | Ankale | 17.0540 | 75.0165 | 7 | Amruthwadi | 17.0365 | 75.2664 |
| 8 | Ankale | 17.0270 | 75.0417 | 8 | Amruthwadi | 17.0373 | 75.2750 |
| 9 | Antral | 17.1701 | 75.2158 | 9 | Amruthwadi | 17.0447 | 75.2744 |
| 10 | Asangi | 17.0847 | 75.4377 | 10 | Ankalagi | 17.1301 | 75.4912 |
| 11 | Asangi Turk | 16.9980 | 75.4987 | 11 | Ankalagi | 17.1225 | 75.5060 |
| 12 | Asangi Turk | 16.9935 | 75.5095 | 12 | Ankalagi | 17.1080 | 75.4968 |
| 13 | Asangi Turk | 16.9940 | 75.5140 | 13 | Ankale | 17.0443 | 75.0231 |
| 14 | Avandhi | 17.2136 | 75.2061 | 14 | Antral | 17.1700 | 75.2166 |
| 15 | Avandhi | 17.2201 | 75.2037 | 15 | Antral | 17.1703 | 75.2174 |
| 16 | Bagalwadi | 17.1984 | 75.1454 | 16 | Asangi | 17.0845 | 75.4377 |
| 17 | Bagalwadi | 17.2017 | 75.1505 | 17 | Avandhi | 17.3359 | 75.2061 |
| 18 | Bagewadi | 17.0762 | 75.1337 | 18 | Avandhi | 17.2184 | 75.2033 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | Shallow Aquifer | | | | Deeper Aquifer | | |
| 19 | Bagewadi | 17.0756 | 75.1240 | 19 | Avandhi | 17.2202 | 75.2036 |
| 20 | Baj | 17.0470 | 75.0753 | 20 | Avandhi | 17.2204 | 75.2015 |
| 21 | Baj | 17.0463 | 75.0618 | 21 | Bagalwadi | 17.1967 | 75.1349 |
| 22 | Balgaon | 17.1935 | 75.6046 | 22 | Bagalwadi | 17.1973 | 75.1473 |
| 23 | Banali | 17.1467 | 75.2134 | 23 | Bagewadi | 17.0733 | 75.1245 |
| 24 | Banali | 17.1414 | 75.2139 | 24 | Bagewadi | 17.0724 | 75.1242 |
| 25 | Banali | 17.1438 | 75.2133 | 25 | Baj | 17.0478 | 75.0647 |
| 26 | Banali | 17.1413 | 75.2159 | 26 | Baj | 17.0448 | 75.0621 |
| 27 | Belondgi | 17.1722 | 75.5842 | 27 | Balgaon | 17.1925 | 75.6036 |
| 28 | Belunki | 17.0395 | 75.0909 | 28 | Balgaon | 17.1917 | 75.6024 |
| 29 | Belunki | 17.0355 | 75.0825 | 29 | Banali | 17.1466 | 75.2113 |
| 30 | Bevanur | 17.2045 | 75.0433 | 30 | Basargi | 16.8997 | 75.1851 |
| 31 | Bilur | 16.9254 | 75.1891 | 31 | Belondgi | 17.1748 | 75.5854 |
| 32 | Bilur | 16.9644 | 75.1800 | 32 | Belunki | 17.0355 | 75.0829 |
| 33 | Bilur | 16.9357 | 75.1677 | 33 | Bevanur | 17.2173 | 75.0697 |
| 34 | Bilur | 16.9538 | 75.1554 | 34 | Bhivargi | 17.0950 | 75.5653 |
| 35 | Birnal | 17.0955 | 75.1505 | 35 | Bhivargi | 17.0768 | 75.5619 |
| 36 | Birnal | 17.0928 | 75.1497 | 36 | Bilur | 16.9533 | 75.1594 |
| 37 | Choleshwar | 17.1458 | 75.3119 | 37 | Bilur | 16.9462 | 75.1780 |
| 38 | Dafalapur | 17.0009 | 75.0717 | 38 | Birnal | 17.0978 | 75.1514 |
| 39 | Dafalapur | 16.9860 | 75.0474 | 39 | Borgi Khurd | 17.1381 | 75.5822 |
| 40 | Dafalapur | 16.9741 | 75.0712 | 40 | Borgi Khurd | 17.1378 | 75.5869 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 41 | Dafalapur | 17.0156 | 75.0490 | 41 | Borgi Khurd | 17.1306 | 75.5964 |
| 42 | Dafalapur | 16.9952 | 75.0444 | 42 | Choleshwar | 17.1446 | 75.3115 |
| 43 | Dafalapur | 16.9913 | 75.0379 | 43 | Dafalapur | 17.0004 | 75.0711 |
| 44 | Dafalapur | 16.9857 | 75.0377 | 44 | Dafalapur | 17.0104 | 75.1065 |
| 45 | Daribachiwadi | 17.0305 | 75.4233 | 45 | Daribachiwadi | 17.0330 | 75.4229 |
| 46 | Daribachiwadi | 17.0330 | 75.4229 | 46 | Daribadachi | 17.0201 | 75.4106 |
| 47 | Daribachiwadi | 17.0316 | 75.4246 | 47 | Darikonur | 17.0274 | 75.3702 |
| 48 | Daribadachi | 17.0335 | 75.4216 | 48 | Darikonur | 17.0222 | 75.3700 |
| 49 | Daribadachi | 17.0431 | 75.4078 | 49 | Darikonur | 17.0215 | 75.3708 |
| 50 | Daribadachi | 17.0214 | 75.4527 | 50 | Devnal | 17.0223 | 75.2671 |
| 51 | Daribadachi | 17.0191 | 75.4587 | 51 | Devnal | 17.0116 | 75.2628 |
| 52 | Darikonur | 17.0423 | 75.3822 | 52 | Devnal | 17.0145 | 75.2389 |
| 53 | Darikonur | 17.0360 | 75.3783 | 53 | Devnal | 17.0026 | 75.2447 |
| 54 | Darikonur | 17.0244 | 75.3778 | 54 | Dhavadwadi | 17.1190 | 75.0726 |
| 55 | Devnal | 17.0050 | 75.2538 | 55 | Dhavadwadi | 17.1195 | 75.0724 |
| 56 | Devnal | 17.0014 | 75.2454 | 56 | Dhulkarwadi | 16.9687 | 75.5071 |
| 57 | Dhavadwadi | 17.1198 | 75.0705 | 57 | Dorli | 17.0715 | 75.4977 |
| 58 | Dhavadwadi | 17.1194 | 75.0703 | 58 | Dorli | 17.0799 | 74.9968 |
| 59 | Dhulkarwadi | 16.9689 | 75.5062 | 59 | Dorli | 17.0794 | 74.9971 |
| 60 | Dorli | 17.0813 | 75.0034 | 60 | Ekundi | 16.9286 | 75.1125 |
| 61 | Dorli | 17.0889 | 75.0159 | 61 | Ekundi | 16.9245 | 75.1007 |
| 62 | Ekundi | 16.9261 | 75.1078 | 62 | Ekundi | 16.9381 | 75.0999 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 63 | Ekundi | 16.9274 | 75.0991 | 63 | Girgaon | 17.1022 | 75.6508 |
| 64 | Girgaon | 17.0849 | 75.6587 | 64 | Goleshwar | 17.1459 | 75.3140 |
| 65 | Girgaon | 17.0867 | 75.6585 | 65 | Gugwad | 16.8947 | 75.1460 |
| 66 | Goleshwar | 17.1465 | 75.3192 | 66 | Gulgunjal | 17.0269 | 75.6486 |
| 67 | Goleshwar | 17.1411 | 75.3155 | 67 | Gulgunjal | 17.0270 | 75.6600 |
| 68 | Guddapur | 17.0860 | 75.4027 | 68 | Gulvanchi | 17.1729 | 75.0846 |
| 69 | Gugwad | 16.8800 | 75.1455 | 69 | Gulvanchi | 17.1714 | 75.0753 |
| 70 | Gulgunjal | 16.9997 | 75.5491 | 70 | Hivre | 17.1009 | 75.0579 |
| 71 | Gulvanchi | 17.1726 | 75.0827 | 71 | Hivre | 17.1003 | 75.0583 |
| 72 | Hivre | 17.1006 | 75.0599 | 72 | Jadraboblad | 17.2034 | 75.4232 |
| 73 | Hivre | 17.1000 | 75.0627 | 73 | Jat | 17.0457 | 75.2174 |
| 74 | Jadraboblad | 17.2206 | 75.4306 | 74 | Jat | 17.0533 | 75.2671 |
| 75 | Jalyal Kh | 16.9946 | 75.4473 | 75 | Jat | 17.0768 | 75.2200 |
| 76 | Jalyal Kh | 16.9968 | 75.4453 | 76 | Jirgyal | 16.9572 | 75.1062 |
| 77 | Jat | 17.0622 | 75.2228 | 77 | Kaganari | 16.9750 | 75.5518 |
| 78 | Jat | 17.0356 | 75.2198 | 78 | Kaganari | 17.0039 | 75.5490 |
| 79 | Jirgyal | 16.9578 | 75.1107 | 79 | Kairao | 17.2120 | 75.3490 |
| 80 | Kaganari | 16.9870 | 75.5504 | 80 | Kanthi | 17.0505 | 75.1476 |
| 81 | Kaganari | 16.9975 | 75.5493 | 81 | Kanthi | 17.0600 | 75.1441 |
| 82 | Kairao | 17.2187 | 75.3516 | 82 | Kanthi | 17.0575 | 75.1276 |
| 83 | Kanthi | 17.0610 | 75.1427 | 83 | Karajangi | 17.1120 | 75.3016 |
| 84 | Karajangi | 17.1120 | 75.3016 | 84 | karajgaon | 17.1373 | 75.5442 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | Shallow Aquifer | | | | Deeper Aquifer | | |
| 85 | karajgaon | 17.1188 | 75.5748 | 85 | karajgaon | 17.1303 | 75.5715 |
| 86 | karajgaon | 17.1152 | 75.5737 | 86 | Karajnagi | 17.1090 | 75.2903 |
| 87 | Karajnagi | 17.1093 | 75.2952 | 87 | Karajnagi | 17.1087 | 75.3084 |
| 88 | Karajnagi | 17.1114 | 75.3043 | 88 | Karajnagi | 17.1274 | 75.3140 |
| 89 | Karewadi | 17.0028 | 75.6301 | 89 | Karajnagi | 17.1115 | 75.3010 |
| 90 | Karewadi | 17.0074 | 75.6212 | 90 | Karewadi | 17.0083 | 75.6153 |
| 91 | Karewadi | 16.9988 | 75.6438 | 91 | Karewadi | 17.0141 | 7.5518 |
| 92 | Kaslingwadi | 17.1823 | 75.1401 | 92 | Karewadi tk | 17.0241 | 75.5575 |
| 93 | Khadnal | 17.0154 | 75.4650 | 93 | Kaslingwadi | 17.1857 | 75.1400 |
| 94 | Khalati | 17.0156 | 75.1317 | 94 | Kaslingwadi | 17.1803 | 75.1448 |
| 95 | Khalati | 17.0005 | 75.1246 | 95 | Kauiko0nur | 17.1654 | 75.3629 |
| 96 | Khandnal | 17.0289 | 75.4735 | 96 | Khadnal | 17.0145 | 75.4665 |
| 97 | Khandnal | 17.0305 | 75.4784 | 97 | Khalati | 17.0087 | 75.1304 |
| 98 | Kolgiri | 17.1065 | 75.3252 | 98 | Khalati | 16.9985 | 75.1249 |
| 99 | Kolgiri | 17.1051 | 75.3338 | 99 | Khandnal | 17.0291 | 75.4778 |
| 100 | Kolgiri | 17.1011 | 75.3434 | 100 | Khandnal | 17.0392 | 75.4866 |
| 101 | Kontya Boblad | 16.9998 | 75.6408 | 101 | Khilarwadi | 16.9419 | 75.1396 |
| 102 | Kontya Boblad | 17.0111 | 75.6494 | 102 | Khilarwadi | 16.9416 | 75.1362 |
| 103 | Kontya Boblad | 16.9992 | 75.6516 | 103 | Khojanwadi | 16.9485 | 75.2442 |
| 104 | Kosari | 17.1523 | 75.1346 | 104 | Khojanwadi | 16.9446 | 75.2480 |
| 105 | Kosari | 17.1440 | 75.1335 | 105 | Khojanwadi | 16.9429 | 75.2562 |
| 106 | Kudnur | 16.9803 | 75.0307 | 106 | Kolgiri | 17.1162 | 75.3427 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 107 | Kudnur | 16.9617 | 75.0355 | 107 | Kolgiri | 17.1044 | 75.3371 |
| 108 | Kulalwadi | 17.1482 | 75.4807 | 108 | Kontya Boblad | 16.9834 | 75.6572 |
| 109 | Kulalwadi | 17.1331 | 75.4538 | 109 | Kosari | 17.1520 | 75.1345 |
| 110 | Kumbhari | 17.1092 | 75.1160 | 110 | Kudnur | 16.9722 | 75.0325 |
| 111 | Kumbhari | 17.1098 | 75.1175 | 111 | Kudnur | 16.9592 | 75.0357 |
| 112 | Lakdewadi | 17.1732 | 75.4198 | 112 | Kulalwadi | 17.1365 | 75.4657 |
| 113 | lakdewadi | 17.1742 | 75.4203 | 113 | Kumbhari | 17.1109 | 75.1177 |
| 114 | Lavanga | 17.0554 | 75.6417 | 114 | Kumbhari | 17.1113 | 75.1175 |
| 115 | Lavanga | 17.0578 | 75.6378 | 115 | Lakdewadi | 17.1805 | 75.4200 |
| 116 | Lohagaon | 17.2470 | 75.2133 | 116 | lakdewadi | 17.1742 | 75.4203 |
| 117 | Lohagaon | 17.2484 | 75.2142 | 117 | Lamantada | 17.1650 | 75.5083 |
| 118 | Madgyel | 17.1326 | 75.4116 | 118 | Lamantada | 17.1682 | 75.5256 |
| 119 | Mendhegiri | 16.9993 | 75.2398 | 119 | Lavanga | 17.0708 | 75.6293 |
| 120 | Mendhegiri | 16.9921 | 75.2345 | 120 | Lohagaon | 17.2489 | 75.2119 |
| 121 | Mirawad | 16.9824 | 75.1255 | 121 | Madgyel | 17.1334 | 75.4109 |
| 122 | Mokhaswadi | 17.1986 | 75.1652 | 122 | Mallal | 17.0160 | 75.2164 |
| 123 | Motewadi | 17.0095 | 75.5243 | 123 | Manik nal | 17.1089 | 75.6168 |
| 124 | Muchandi | 16.9821 | 75.3350 | 124 | Manik nal | 17.1173 | 75.6250 |
| 125 | Muchandi | 16.9835 | 75.3369 | 125 | Mendhegiri | 16.9936 | 75.2412 |
| 126 | Muchandi | 16.9828 | 75.3372 | 126 | Mendhegiri | 16.9645 | 75.2429 |
| 127 | Muchandi | 16.9875 | 75.3501 | 127 | Mendhegiri | 16.9993 | 75.2398 |
| 128 | Munchandi | 16.9793 | 75.3386 | 128 | Mendhegiri | 16.9967 | 75.2423 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 129 | Munchandi | 17.0061 | 75.3924 | 129 | Mendhegiri | 16.9889 | 75.2345 |
| 130 | Naithal | 17.1435 | 75.3655 | 130 | Mirawad | 16.9840 | 75.1176 |
| 131 | Navalwadi | 17.2208 | 75.0867 | 131 | Mirawad | 16.9787 | 75.1024 |
| 132 | Nigadi (kh) | 17.1197 | 75.2713 | 132 | Mirawad | 16.9715 | 75.1258 |
| 133 | Nigadi budruk | 17.2282 | 75.5154 | 133 | Mirawad | 16.9747 | 75.1365 |
| 134 | Nigani kh | 17.1314 | 75.2661 | 134 | Mokhaswadi | 17.2029 | 75.1799 |
| 135 | Nigani kh | 17.1363 | 75.2638 | 135 | Mokhaswadi | 17.1967 | 75.1658 |
| 136 | Nigani kh | 17.1069 | 75.2795 | 136 | Morbagi | 17.1126 | 75.6019 |
| 137 | Pandharwadi | 17.0076 | 75.4724 | 137 | Morbagi | 17.0827 | 75.6208 |
| 138 | Pandherwadi | 17.0409 | 75.5085 | 138 | Motewadi | 17.0049 | 75.5231 |
| 139 | Pandozari | 17.0440 | 75.5175 | 139 | Muchandi | 16.9817 | 75.3032 |
| 140 | Pratapur | 17.1468 | 75.1468 | 140 | Muchandi | 16.9790 | 75.3392 |
| 141 | Pratapur | 17.1479 | 75.0767 | 141 | Muchandi | 16.9808 | 75.3533 |
| 142 | RajbachiWadi | 17.1658 | 75.4251 | 142 | Muchandi | 16.9789 | 75.3368 |
| 143 | Rampur | 17.0451 | 75.1880 | 143 | Muchandi | 16.9973 | 75.3052 |
| 144 | Ravalgundwadi | 16.9812 | 75.3023 | 144 | Navalwadi | 17.2241 | 75.0924 |
| 145 | Ravalgundwadi | 16.9803 | 75.3020 | 145 | Navalwadi | 17.2201 | 75.1000 |
| 146 | Ravalgundwadi | 16.9813 | 75.3032 | 146 | Nigadi (kh) | 17.1192 | 75.2716 |
| 147 | Ravalgundwadi | 16.9771 | 75.2836 | 147 | Nigadi budruk | 17.2393 | 75.5318 |
| 148 | Revnal | 17.1213 | 75.1774 | 148 | Nigadi budruk | 17.2383 | 75.5433 |
| 149 | Revnal | 17.1208 | 75.1788 | 149 | Nigani kh | 17.1347 | 75.2644 |
| 150 | Salekari Patchapur | 17.0333 | 75.2864 | 150 | Nigani kh | 17.1225 | 75.2698 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | Shallow Aquifer | | | | Deeper Aquifer | | |
| 151 | Salekari Patchapur | 17.0444 | 75.3034 | 151 | Pandharwadi | 17.0048 | 75.4789 |
| 152 | Salekari Patchapur | 17.0237 | 75.2998 | 152 | Pandzori | 17.0371 | 75.2228 |
| 153 | Salmalgewadi | 16.9806 | 75.1531 | 153 | Pandzori | 17.0305 | 75.5286 |
| 154 | Salmalgewadi | 16.9562 | 75.1458 | 154 | paradhi wasti | 17.0285 | 75.5223 |
| 155 | Sanamadi | 17.1444 | 75.3418 | 155 | Pratapur | 17.1473 | 75.0753 |
| 156 | Sankh | 17.0595 | 75.5214 | 156 | Pratapur | 17.1351 | 75.0781 |
| 157 | Sankh | 17.0666 | 75.5040 | 157 | RajbachiWadi | 17.0989 | 75.4303 |
| 158 | Sanmadi | 17.1242 | 75.3418 | 158 | Rampur | 17.0449 | 75.1879 |
| 159 | Sanmadi | 17.1444 | 75.3288 | 159 | Rampur | 17.0306 | 75.1759 |
| 160 | Shedyal | 17.0482 | 75.3297 | 160 | Rampur | 17.0450 | 75.1908 |
| 161 | Shedyal | 17.0479 | 75.3311 | 161 | Rampur | 17.0419 | 75.1792 |
| 162 | Shedyal | 17.0463 | 75.3261 | 162 | Ravalgundwadi | 16.9874 | 75.2867 |
| 163 | Shegaon | 17.1563 | 75.1583 | 163 | Salekari Patchapur | 17.0339 | 75.2845 |
| 164 | Shegaon | 17.1581 | 75.1639 | 164 | SalekariPatchapur | 17.0290 | 75.2960 |
| 165 | Shelkewad (N.V.) | 16.9546 | 75.0738 | 165 | Salekari Patchapur | 17.0242 | 75.2942 |
| 166 | Shelkewadi (N.V.) | 16.9555 | 75.0867 | 166 | Sanamadi | 17.1450 | 75.3558 |
| 167 | Siddhanath | 17.0079 | 75.3965 | 167 | Sankh | 17.0878 | 75.4981 |
| 168 | Sindur | 16.8471 | 75.2138 | 168 | Sanmadi | 17.1374 | 75.3416 |
| 169 | Sindur | 16.8630 | 75.2152 | 169 | Sanmadi | 17.1594 | 75.3422 |
| 170 | Singanhalli | 17.2269 | 75.1521 | 170 | Shedyal | 17.0388 | 75.3226 |
| 171 | Singnapur | 16.9454 | 75.0342 | 171 | Shedyal | 17.0477 | 75.3301 |
| 172 | Sonalgi | 17.2531 | 75.6411 | 172 | Shedyal | 17.0465 | 75.3269 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | Shallow Aquifer | | | | Deeper Aquifer | | |
| 173 | Sonyal | 17.1552 | 75.4450 | 173 | Shegaon | 17.1659 | 75.1802 |
| 174 | Soradi | 17.0558 | 75.39.08 | 174 | Shegaon | 17.1656 | 75.1798 |
| 175 | Sordi | 17.0621 | 75.3855 | 175 | Shegaon | 17.1640 | 75.1796 |
| 176 | Tikondi | 17.0337 | 75.5673 | 176 | Shegaon | 17.1641 | 75.1785 |
| 177 | Tikondi | 17.0305 | 75.5701 | 177 | Shelkewadi(N.V.) | 16.9541 | 75.0831 |
| 178 | Tippehalli | 17.0966 | 75.1807 | 178 | Siddhanath | 16.9877 | 75.4198 |
| 179 | Tippehalli | 17.0977 | 75.1774 | 179 | siddhanath | 16.9880 | 75.4190 |
| 180 | Titgal | 17.0643 | 75.4310 | 180 | Sindur | 16.8766 | 75.2117 |
| 181 | Tonewadi | 17.1876 | 75.3481 | 181 | Singanhalli | 17.2273 | 75.1555 |
| 182 | Umadi | 17.2630 | 75.5930 | 182 | Singanhalli | 17.2273 | 75.1579 |
| 183 | Umarani | 16.9298 | 75.2458 | 183 | Singanhalli | 17.2242 | 75.1541 |
| 184 | Umarani | 16.9018 | 75.2511 | 184 | Sonalgi | 17.2532 | 75.6428 |
| 185 | Utwadi | 16.9771 | 75.2664 | 185 | Sonyal | 17.1612 | 75.4653 |
| 186 | Vajrawad | 16.9150 | 75.1427 | 186 | Sonyal | 17.1787 | 75.4495 |
| 187 | Vaspeth | 17.1131 | 75.3997 | 187 | Sonyal | 17.1612 | 75.4653 |
| 188 | Vittalwadi | 17.2668 | 75.5534 | 188 | Soradi | 17.0172 | 75.3850 |
| 189 | Waifal | 17.1528 | 75.2534 | 189 | Soradi | 17.0696 | 75.3972 |
| 190 | Waifal | 17.1581 | 75.2555 | 190 | Sordi | 17.0503 | 75.3983 |
| 191 | Walekhindi | 17.2076 | 75.1117 | 191 | Sordi | 17.0633 | 75.3816 |
| 192 | Walekhindi | 17.2058 | 75.1144 | 192 | Suslad | 17.2262 | 75.6245 |
| 193 | Walsang | 17.0563 | 75.3053 | 193 | Suslad | 17.2265 | 75.6257 |
| 194 | Walsang | 17.0721 | 75.3514 | 194 | Tikondi | 17.0401 | 75.5829 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 195 | Walsang | 17.0723 | 75.3189 | 195 | Tikondi | 17.0176 | 75.5956 |
| 196 | Washan | 17.0346 | 75.1532 | 196 | Tippehalli | 17.0964 | 75.1774 |
| 197 | Yeldari | 16.9887 | 75.1858 | 197 | Tippehalli | 17.0988 | 75.1679 |
| 198 | Yeldari | 16.9928 | 75.1985 | 198 | Titgal | 17.0631 | 75.4309 |
| 199 | Yeldari | 16.9894 | 75.1893 | 199 | Tonewadi | 12.2187 | 75.3487 |
| 200 | Yelui | 17.1961 | 75.3101 | 200 | Ugadi | 17.2158 | 75.5099 |
| 201 | Yelui | 17.2013 | 75.3133 | 201 | Ugadi | 17.1865 | 75.5136 |
| | | | | 202 | Umadi | 17.2483 | 75.5637 |
| | | | | 203 | Umadi | 17.2384 | 75.5978 |
| | | | | 204 | Umarani | 16.9113 | 75.2499 |
| | | | | 205 | Umarani | 16.9032 | 75.2513 |
| | | | | 206 | Umarani | 16.9036 | 75.2511 |
| | | | | 207 | Umrani | 16.8941 | 75.2538 |
| | | | | 208 | Utwadi | 16.9840 | 75.2602 |
| | | | | 209 | Utwadi | 16.9777 | 75.2664 |
| | | | | 210 | Utwadi | 16.9772 | 75.2738 |
| | | | | 211 | Vaspeth | 17.1131 | 75.3997 |
| | | | | 212 | Vittalwadi | 17.2654 | 75.5645 |
| | | | | 213 | Vittalwadi | 17.2692 | 75.5481 |
| | | | | 214 | Waifal | 17.1588 | 75.2540 |
| | | | | 215 | Waifal | 17.1602 | 75.2542 |
| | | | | 216 | Waifal | 17.1590 | 75.2553 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | Shallow Aquifer | | | | Deeper Aquifer | | |
| | | | | 217 | Walekhindi | 17.2028 | 75.1160 |
| | | | | 218 | Walsang | 17.0609 | 75.3157 |
| | | | | 219 | Walsang | 17.0665 | 75.3351 |
| | | | | 220 | Washan | 17.0284 | 75.1570 |
| | | | | 221 | Yeldari | 16.9865 | 75.1817 |
| | | | | 222 | Yelvi | 17.1898 | 75.3092 |
| | | | | 223 | Yelvi | 17.1961 | 75.3101 |

## Annexure-IV

Location of Ground Water Samples from Shallow & Deeper Aquifer During Post-monsoon Season (2023).

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 1 | Amruthwadi | 17.0371 | 75.2751 | 1 | Abachiwadi | 17.1760 | 75.3810 |
| 2 | Amruthwadi | 17.0401 | 75.2752 | 2 | Akkalwadi | 17.1345 | 75.6259 |
| 3 | Amruthwadi | 17.0345 | 75.2734 | 3 | Amruthwadi | 17.0365 | 75.2664 |
| 4 | Ankale | 17.054 | 75.0165 | 4 | Amruthwadi | 17.0371 | 75.2751 |
| 5 | Asangi | 17.0847 | 75.4377 | 5 | Amruthwadi | 17.0401 | 75.2752 |
| 6 | Bagalwadi | 17.2017 | 75.1505 | 6 | Amruthwadi | 17.0447 | 75.2744 |
| 7 | Baj | 17.047 | 75.0753 | 7 | Amruthwadi | 17.0345 | 75.2734 |
| 8 | Baj | 17.0463 | 75.0618 | 8 | Ankale | 17.0540 | 75.0165 |
| 9 | Balgaon | 17.1935 | 75.6046 | 9 | Asangi | 17.0845 | 75.4377 |
| 10 | Belondgi | 17.1722 | 75.5842 | 10 | Asangi | 17.0847 | 75.4377 |
| 11 | Belunki | 17.0355 | 75.0825 | 11 | Avandhi | 17.2184 | 75.2033 |
| 12 | Birnal | 17.0928 | 75.1497 | 12 | Avandhi | 17.2202 | 75.2036 |
| 13 | Dafalapur | 17.0156 | 75.0490 | 13 | Avandhi | 17.2204 | 75.2015 |
| 14 | Daribadachi | 17.0431 | 75.4078 | 14 | Bagalwadi | 17.1967 | 75.1349 |
| 15 | Daribadchi | 17.0305 | 75.4233 | 15 | Bagalwadi | 17.2017 | 75.1505 |
| 16 | Daribadchi | 17.033 | 75.4229 | 16 | Bagalwadi | 17.1973 | 75.1473 |
| 17 | Devnal | 17.0014 | 75.2454 | 17 | Bagewadi | 17.0733 | 75.1245 |
| 18 | Dhulkarwadi | 16.9689 | 75.5062 | 18 | Baj | 17.0477 | 75.0688 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 19 | Dorli | 17.0813 | 75.0034 | 19 | Baj | 17.0470 | 75.0753 |
| 20 | Ekundi | 16.9262 | 75.1078 | 20 | Baj | 17.0463 | 75.0618 |
| 21 | Ekundi | 16.9274 | 75.0991 | 21 | Balgaon | 17.1925 | 75.6036 |
| 22 | Gholeshwar | 17.1458 | 75.3119 | 22 | Balgaon | 17.1935 | 75.6046 |
| 23 | Guddapur | 17.086 | 75.4027 | 23 | Balgaon | 17.1917 | 75.6024 |
| 24 | Hivre | 17.1006 | 75.0599 | 24 | Banali | 17.1466 | 75.2113 |
| 25 | Jalyal Kh | 16.9968 | 75.4453 | 25 | Belondgi | 17.1748 | 75.5854 |
| 26 | Jat | 17.0356 | 75.2198 | 26 | Belondgi | 17.1722 | 75.5842 |
| 27 | Jigyral | 16.9578 | 75.1107 | 27 | Belunki | 17.0355 | 75.0829 |
| 28 | Kaniknour | 17.1654 | 75.3624 | 28 | Belunki | 17.0355 | 75.0825 |
| 29 | Kanthi | 17.061 | 75.1427 | 29 | Bhivargi | 17.0950 | 75.5653 |
| 30 | Karajargi | 17.112 | 75.3016 | 30 | Bilur | 16.9533 | 75.1594 |
| 31 | Karajgaon | 17.1188 | 75.5748 | 31 | Birnal | 17.0978 | 75.1514 |
| 32 | Karajgaon | 17.1152 | 75.5737 | 32 | Birnal | 17.0928 | 75.1497 |
| 33 | Karajnagi | 17.1114 | 75.3043 | 33 | Borgi Khurd | 17.1381 | 75.5822 |
| 34 | Kaslingwadi | 17.1823 | 75.1401 | 34 | Borgi Khurd | 17.1378 | 75.5869 |
| 35 | Khairao | 17.2187 | 75.3516 | 35 | Dafalapur | 17.0156 | 75.0490 |
| 36 | Khairao | 17.2120 | 75.3490 | 36 | Daribadachi | 17.0431 | 75.4078 |
| 37 | Kolgiri | 17.1051 | 75.3338 | 37 | Daribadchi | 17.0330 | 75.4229 |
| 38 | Kolgiri | 17.1011 | 75.3434 | 38 | Daribadchi | 17.0305 | 75.4233 |
| 39 | Kudnur | 16.9803 | 75.0307 | 39 | Daribadchi | 17.0330 | 75.4229 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 40 | Kudnur | 16.9617 | 75.0355 | 40 | Devnal | 17.0014 | 75.2454 |
| 41 | Kumbhari | 17.1092 | 75.1160 | 41 | Devnal | 17.0026 | 75.2447 |
| 42 | Lakdewadi | 17.1742 | 75.4203 | 42 | Dhulkarwadi | 16.9689 | 75.5062 |
| 43 | Lohagaon | 17.2484 | 75.2142 | 43 | Dorli | 17.0801 | 74.9977 |
| 44 | Madgyal | 17.1326 | 75.4116 | 44 | Dorli | 17.0799 | 74.9968 |
| 45 | Maithal | 17.1435 | 75.3655 | 45 | Dorli | 17.0794 | 74.9971 |
| 46 | Muchandi | 16.9835 | 75.3369 | 46 | Dorli | 17.0813 | 75.0034 |
| 47 | Munchandi | 16.9793 | 75.3386 | 47 | Ekundi | 16.9286 | 75.1125 |
| 48 | Nigadi (kh) | 17.1197 | 75.2713 | 48 | Ekundi | 16.9262 | 75.1078 |
| 49 | Nigadi Budruk | 17.2282 | 75.5154 | 49 | Ekundi | 16.9245 | 75.1007 |
| 50 | NiganiKh | 17.1314 | 75.2661 | 50 | Ekundi | 16.9274 | 75.0991 |
| 51 | NiganiKh | 17.1069 | 75.2795 | 51 | Ekundi | 16.9381 | 75.0999 |
| 52 | Pandozari | 17.044 | 75.5175 | 52 | Gholeshwar | 17.1458 | 75.3119 |
| 53 | Pratapur | 17.1468 | 75.1468 | 53 | Gholeshwar | 17.1446 | 75.3115 |
| 54 | RajbachiWadi | 17.1658 | 75.4251 | 54 | Guddapur | 17.0860 | 75.4027 |
| 55 | Ravalgundwadi | 16.9813 | 75.3032 | 55 | Gugwad | 16.8947 | 75.1460 |
| 56 | Ravalgundwadi | 16.9771 | 75.2836 | 56 | Hivre | 17.1006 | 75.0599 |
| 57 | Ravalgundwadi | 16.9812 | 75.3023 | 57 | Jalyal Kh | 16.9968 | 75.4453 |
| 58 | Salekari Patchapur | 17.0333 | 75.2864 | 58 | Jat | 17.0356 | 75.2198 |
| 59 | Salekari Patchapur | 17.0237 | 75.2998 | 59 | Jigyral | 16.9578 | 75.1107 |
| 60 | Sankh | 17.0666 | 75.5040 | 60 | Jirgyal | 16.9572 | 75.1062 |

| S. No. | Location | Latitudes | Longitude | S. No. | Location | Latitude | Longitude |
|---|---|---|---|---|---|---|---|
| | **Shallow Aquifer** | | | | **Deeper Aquifer** | | |
| 61 | Sankh | 17.0595 | 75.5214 | 61 | Kaniknour | 17.1654 | 75.3624 |
| 62 | Shedyal | 17.0463 | 75.3261 | 62 | Kanthi | 17.0610 | 75.1427 |
| 63 | Sindur | 16.8471 | 75.2138 | 63 | Karajargi | 17.1120 | 75.3016 |
| 64 | Sindur | 16.863 | 75.2152 | 64 | Karajargi | 17.1120 | 75.3016 |
| 65 | Sonamadi | 17.1439 | 75.3412 | 65 | Karajgaon | 17.1188 | 75.5748 |
| 66 | Soradi | 17.0558 | 75.3908 | 66 | Karajgaon | 17.1152 | 75.5737 |
| 67 | Sordi | 17.0621 | 75.3855 | 67 | Karajgaon | 17.1373 | 75.5442 |
| 68 | Suslad | 17.2226 | 75.6387 | 68 | Karajnagi | 17.1091 | 75.2903 |
| 69 | Tilyal | 17.0643 | 75.4310 | 69 | Karajnagi | 17.1114 | 75.3043 |
| 70 | Tippehalli | 17.0966 | 75.1807 | 70 | Kaslingwadi | 17.1823 | 75.1401 |
| 71 | Tonewadi | 17.1876 | 75.3481 | 71 | Khairao | 17.2120 | 75.3490 |
| 72 | Umadi | 17.263 | 75.5930 | 72 | Khairao | 17.2187 | 75.3516 |
| 73 | Vaspeth | 17.1191 | 75.3786 | 73 | Khairao | 17.2120 | 75.3490 |
| 74 | Vittalwadi | 17.2668 | 75.5534 | 74 | Khilarwadi | 16.9416 | 75.1362 |
| 75 | Yeldari | 16.9894 | 75.1893 | 75 | Khojanwadi | 16.9429 | 75.2562 |
| 76 | Yelui | 17.1961 | 75.3101 | 76 | Khojanwadi | 16.9446 | 75.2480 |
| | - | - | - | 77 | Khojanwadi | 16.9485 | 75.2442 |
| | - | - | - | 78 | Kolgiri | 17.1051 | 75.3338 |
| | - | - | - | 79 | Kolgiri | 17.1044 | 75.3371 |
| | - | - | - | 80 | Kolgiri | 17.1011 | 75.3434 |

| S. No. | Location | Latitude | Longitude |
|---|---|---|---|
| | **Deeper Aquifer** | | |
| 81 | Kudnur | 16.9803 | 75.0307 |
| 82 | Kudnur | 16.9722 | 75.0325 |
| 83 | Kudnur | 16.9617 | 75.0355 |
| 84 | Kulalwadi | 17.1365 | 75.4657 |
| 85 | Kumbhari | 17.1092 | 75.1160 |
| 86 | Kumbhari | 17.1109 | 75.1177 |
| 87 | Lakdewadi | 17.1742 | 75.4203 |
| 88 | Lakdewadi | 17.1742 | 75.4203 |
| 89 | Lohagaon | 17.2484 | 75.2142 |
| 90 | Lohagaon | 17.2489 | 75.2119 |
| 91 | Madgyal | 17.1334 | 75.4109 |
| 92 | Madgyal | 17.1326 | 75.4116 |
| 93 | Maithal | 17.1438 | 75.3650 |
| 94 | Maithal | 17.1435 | 75.3655 |
| 95 | Mallal | 17.0160 | 75.2164 |
| 96 | Manik Nal | 17.1089 | 75.6168 |
| 97 | Mendhegiri | 16.9967 | 75.2423 |
| 98 | Mokhaswadi | 17.1967 | 75.1658 |
| 99 | Morbagi | 17.1126 | 75.6019 |
| 100 | Muchandi | 16.9808 | 75.3533 |
| 101 | Muchandi | 16.9973 | 75.3052 |
| 102 | Muchandi | 16.9835 | 75.3369 |

| S. No. | Location | Latitude | Longitude |
|---|---|---|---|
| | Deeper Aquifer | | |
| 103 | Muchandi | 16.9789 | 75.3368 |
| 104 | Munchandi | 16.9793 | 75.3386 |
| 105 | Nigadi (kh) | 17.1192 | 75.2716 |
| 106 | Nigadi (kh) | 17.1197 | 75.2713 |
| 107 | Nigadi Budruk | 17.2282 | 75.5154 |
| 108 | Nigadi Budruk | 17.2393 | 75.5318 |
| 109 | NiganiKh | 17.1314 | 75.2661 |
| 110 | NiganiKh | 17.1069 | 75.2795 |
| 111 | Pandozari | 17.0440 | 75.5175 |
| 112 | Pratapur | 17.1468 | 75.1468 |
| 113 | RajbachiWadi | 17.0989 | 75.4303 |
| 114 | RajbachiWadi | 17.1658 | 75.4251 |
| 115 | Ravalgundwadi | 16.9813 | 75.3032 |
| 116 | Ravalgundwadi | 16.9771 | 75.2836 |
| 117 | Ravalgundwadi | 16.9812 | 75.3023 |
| 118 | Salekari Patchapur | 17.0339 | 75.2845 |
| 119 | Salekari Patchapur | 17.0333 | 75.2864 |
| 120 | Salekari Patchapur | 17.0290 | 75.2960 |
| 121 | Salekari Patchapur | 17.0237 | 75.2998 |
| 122 | Sanamadi | 17.1450 | 75.3558 |
| 123 | Sankh | 17.0666 | 75.5040 |
| 124 | Sankh | 17.0595 | 75.5214 |

| S. No. | Location | Latitude | Longitude |
|---|---|---|---|
| | Deeper Aquifer | | |
| 125 | Sankh | 17.0878 | 75.4981 |
| 126 | Shedyal | 17.0463 | 75.3261 |
| 127 | Shedyal | 17.0388 | 75.3226 |
| 128 | Shegaon | 17.1640 | 75.1796 |
| 129 | Sindur | 16.8471 | 75.2138 |
| 130 | Sindur | 16.8630 | 75.2152 |
| 131 | Singanhalli | 17.2273 | 75.1555 |
| 132 | Singanhalli | 17.2242 | 75.1541 |
| 133 | Sonalgi | 17.2532 | 75.6428 |
| 134 | Sonamadi | 17.1439 | 75.3412 |
| 135 | Sonyal | 17.1612 | 75.4653 |
| 136 | Soradi | 17.0712 | 75.3850 |
| 137 | Soradi | 17.0696 | 75.3972 |
| 138 | Soradi | 17.0558 | 75.3908 |
| 139 | Soradi | 17.0621 | 75.3855 |
| 140 | Suslad | 17.2262 | 75.6245 |
| 141 | Suslad | 17.2265 | 75.6257 |
| 142 | Suslad | 17.2226 | 75.6387 |
| 143 | Tikondi | 17.0305 | 75.5701 |
| 144 | Tilyal | 17.0631 | 75.4309 |
| 145 | Tilyal | 17.0643 | 75.4310 |
| 146 | Tippehalli | 17.0966 | 75.1807 |

| S. No. | Location | Latitude | Longitude |
|---|---|---|---|
| | Deeper Aquifer | | |
| 147 | Tonewadi | 12.2187 | 75.3487 |
| 148 | Tonewadi | 17.1876 | 75.3481 |
| 149 | Utgi | 17.1865 | 75.5136 |
| 150 | Umadi | 17.2483 | 75.5637 |
| 151 | Umadi | 17.2630 | 75.5930 |
| 152 | Umadi | 17.2384 | 75.5978 |
| 153 | Utgi | 17.2158 | 75.5099 |
| 154 | Utwadi | 16.9777 | 75.2664 |
| 155 | Utwadi | 16.9772 | 75.2738 |
| 156 | Utwadi | 16.9840 | 75.2602 |
| 157 | Vaspeth | 17.1191 | 75.3786 |
| 158 | Vittalwadi | 17.2654 | 75.5645 |
| 159 | Vittalwadi | 17.2668 | 75.5534 |
| 160 | Waifal | 17.1590 | 75.2553 |
| 161 | Walsang | 17.0610 | 75.3157 |
| 162 | Yeldari | 16.9894 | 75.1893 |
| 163 | Yelvi | 17.1898 | 75.3092 |
| 164 | Yelvi | 17.1898 | 75.3092 |
| 165 | Yelvi | 17.1898 | 75.3092 |
| 166 | Yelvi | 17.1961 | 75.3101 |

## Annexure-V

Major Ion Chemistry of Ground Water Samples from Shallow Aquifer (Aquifer-1), Pre-monsoon Season (2023).

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^-$ | $Cl^-$ | $SO_4^{2-}$ | $NO_3^-$ | $F^-$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <--------------------------- mg/L ---------------------------> | | | | | | | | | | |
| 1 | 7.75 | 884 | 295 | 48 | 43 | 50 | 0 | 0 | 311 | 85 | 48 | 17 | 0.6 |
| 2 | 7.27 | 2479 | 760 | 84 | 134 | 143 | 1 | 0 | 354 | 440 | 235 | 19 | 0.5 |
| 3 | 7.34 | 4995 | 1310 | 194 | 200 | 610 | 3 | 0 | 683 | 766 | 904 | 41 | 1 |
| 4 | 7.46 | 4111 | 990 | 74 | 196 | 424 | 3 | 0 | 647 | 510 | 702 | 77 | 1.1 |
| 5 | 7.29 | 4711 | 1720 | 116 | 347 | 322 | 2 | 0 | 500 | 808 | 786 | 96 | 0.9 |
| 6 | 7.66 | 3690 | 1060 | 222 | 123 | 329 | 5 | 0 | 336 | 567 | 841 | 18 | 0.6 |
| 7 | 7.51 | 1683 | 480 | 60 | 80 | 155 | 1 | 0 | 433 | 145 | 270 | 49 | 1 |
| 8 | 7.45 | 900 | 360 | 48 | 58 | 41 | 1 | 0 | 323 | 96 | 73 | 14 | 0.7 |
| 9 | 7.56 | 781 | 250 | 26 | 45 | 55 | 2 | 0 | 336 | 50 | 47 | 10 | 0.5 |
| 10 | 7.58 | 1294 | 380 | 56 | 58 | 88 | 1 | 0 | 433 | 103 | 75 | 61 | 0.4 |
| 11 | 7.4 | 1456 | 445 | 126 | 32 | 109 | 0 | 0 | 336 | 213 | 159 | 5 | 0.5 |
| 12 | 7.7 | 3165 | 530 | 36 | 107 | 438 | 1 | 0 | 641 | 489 | 353 | 15 | 0.6 |
| 13 | 7.42 | 1802 | 515 | 78 | 78 | 155 | 2 | 0 | 323 | 284 | 229 | 7 | 0.5 |
| 14 | 7.64 | 547 | 155 | 24 | 23 | 91 | 0 | 0 | 293 | 35 | 23 | 7 | 0.6 |
| 15 | 7.16 | 1180 | 275 | 40 | 43 | 134 | 16 | 0 | 543 | 106 | 23 | 15 | 0.4 |
| 16 | 7.44 | 10160 | 2200 | 273 | 369 | 1112 | 3 | 0 | 445 | 1843 | 1820 | 24 | 0.5 |
| 17 | 7.48 | 3097 | 840 | 184 | 92 | 264 | 3 | 0 | 336 | 539 | 404 | 89 | 1.1 |
| 18 | 7.77 | 541 | 195 | 50 | 17 | 36 | 0 | 0 | 262 | 32 | 22 | 2 | 0.6 |
| 19 | 7.59 | 775 | 285 | 62 | 32 | 42 | 7 | 0 | 317 | 43 | 60 | 34 | 0.6 |
| 20 | 7.38 | 699 | 260 | 48 | 34 | 35 | 2 | 0 | 287 | 35 | 37 | 49 | 0.7 |
| 21 | 7.24 | 1156 | 385 | 50 | 63 | 69 | 2 | 0 | 384 | 106 | 53 | 71 | 0.6 |
| 22 | 7.51 | 8684 | 2500 | 525 | 289 | 797 | 5 | 0 | 452 | 1617 | 1685 | 38 | 0.6 |
| 23 | 7.28 | 1095 | 355 | 56 | 52 | 58 | 9 | 0 | 415 | 71 | 71 | 9 | 0.5 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <---------------------------- | | | | | mg/L | | ------------------> | | | |
| 24 | 7.47 | 706 | 240 | 48 | 29 | 31 | 0 | 0 | 275 | 39 | 24 | 29 | 0.7 |
| 25 | 7.33 | 805 | 230 | 42 | 30 | 36 | 0 | 0 | 262 | 39 | 31 | 26 | 0.6 |
| 26 | 7.48 | 782 | 260 | 34 | 43 | 35 | 0 | 0 | 299 | 39 | 39 | 31 | 0.6 |
| 27 | 7.52 | 8456 | 1780 | 385 | 199 | 1059 | 33 | 0 | 543 | 1134 | 1848 | 83 | 0.7 |
| 28 | 7.44 | 765 | 320 | 60 | 41 | 36 | 1 | 0 | 305 | 39 | 36 | 29 | 0.6 |
| 29 | 7.3 | 886 | 335 | 26 | 66 | 58 | 1 | 0 | 366 | 53 | 55 | 62 | 0.7 |
| 30 | 7.42 | 1869 | 490 | 44 | 92 | 161 | 1 | 0 | 531 | 277 | 88 | 11 | 0.5 |
| 31 | 7 | 1001 | 300 | 66 | 33 | 90 | 5 | 0 | 220 | 174 | 61 | 7 | 0.8 |
| 32 | 7.13 | 865 | 115 | 40 | 4 | 160 | 2 | 0 | 214 | 99 | 135 | 9 | 0.9 |
| 33 | 7.29 | 1410 | 520 | 102 | 64 | 62 | 1 | 0 | 311 | 145 | 228 | 18 | 0.5 |
| 34 | 7.78 | 1071 | 290 | 96 | 12 | 99 | 1 | 0 | 372 | 103 | 82 | 20 | 0.7 |
| 35 | 7.68 | 1124 | 365 | 82 | 39 | 88 | 1 | 0 | 458 | 99 | 66 | 20 | 0.9 |
| 36 | 7.44 | 1447 | 460 | 78 | 64 | 105 | 0 | 0 | 464 | 167 | 85 | 49 | 0.7 |
| 37 | 7.55 | 882 | 280 | 82 | 18 | 61 | 1 | 0 | 360 | 57 | 64 | 11 | 0.6 |
| 38 | 6.96 | 367 | 140 | 24 | 19 | 31 | 2 | 0 | 146 | 28 | 31 | 3 | 0.3 |
| 39 | 7.33 | 799 | 315 | 84 | 26 | 32 | 0 | 0 | 238 | 60 | 102 | 34 | 0.5 |
| 40 | 7.33 | 1000 | 355 | 60 | 50 | 81 | 1 | 0 | 439 | 60 | 81 | 12 | 0.7 |
| 41 | 7.41 | 1081 | 415 | 86 | 49 | 56 | 1 | 0 | 336 | 121 | 87 | 50 | 0.7 |
| 42 | 7.61 | 402 | 160 | 36 | 17 | 29 | 1 | 0 | 177 | 28 | 29 | 6 | 0.4 |
| 43 | 7.45 | 685 | 270 | 48 | 36 | 34 | 1 | 0 | 323 | 32 | 38 | 18 | 0.5 |
| 44 | 7.43 | 3340 | 1270 | 391 | 72 | 188 | 1 | 0 | 287 | 401 | 961 | 41 | 0.6 |
| 45 | 7.37 | 6181 | 1635 | 353 | 183 | 528 | 2 | 0 | 488 | 1078 | 558 | 40 | 0.5 |
| 46 | 7.39 | 2638 | 770 | 160 | 90 | 152 | 14 | 0 | 464 | 362 | 224 | 81 | 0.5 |
| 47 | 7.35 | 2536 | 850 | 148 | 117 | 93 | 2 | 0 | 439 | 355 | 208 | 96 | 0.4 |
| 48 | 7.25 | 2035 | 530 | 66 | 89 | 209 | 19 | 0 | 378 | 319 | 180 | 4 | 0.8 |
| 49 | 7.63 | 4920 | 1110 | 144 | 182 | 578 | 1 | 0 | 244 | 652 | 1003 | 71 | 0.6 |

| ID* | pH | EC µS/cm | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^-$ | $Cl^-$ | $SO_4^{2-}$ | $NO_3^-$ | $F^-$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | <------ | | | | | mg/L | | | | ------> | |
| 50 | 7.11 | 1278 | 360 | 86 | 35 | 101 | 8 | 0 | 476 | 121 | 75 | 11 | 0.8 |
| 51 | 7.49 | 2089 | 505 | 128 | 45 | 189 | 1 | 0 | 494 | 241 | 219 | 14 | 0.7 |
| 52 | 7.36 | 2611 | 725 | 110 | 109 | 82 | 1 | 0 | 330 | 241 | 185 | 35 | 0.5 |
| 53 | 7.48 | 1443 | 425 | 62 | 66 | 89 | 0 | 0 | 458 | 110 | 113 | 22 | 0.6 |
| 54 | 7.2 | 1491 | 520 | 76 | 80 | 54 | 8 | 0 | 567 | 135 | 33 | 15 | 0.4 |
| 55 | 7.67 | 2166 | 605 | 118 | 75 | 181 | 2 | 0 | 513 | 206 | 302 | 78 | 0.7 |
| 56 | 6.97 | 2305 | 870 | 142 | 125 | 116 | 2 | 0 | 415 | 238 | 416 | 117 | 0.6 |
| 57 | 7.58 | 916 | 260 | 44 | 36 | 86 | 1 | 0 | 415 | 50 | 61 | 20 | 0.5 |
| 58 | 7.49 | 885 | 295 | 26 | 56 | 63 | 1 | 0 | 415 | 50 | 54 | 7 | 0.5 |
| 59 | 7.67 | 1425 | 340 | 42 | 57 | 142 | 2 | 0 | 421 | 152 | 131 | 14 | 0.5 |
| 60 | 7.46 | 1002 | 390 | 24 | 80 | 51 | 0 | 0 | 336 | 92 | 83 | 48 | 0.4 |
| 61 | 7.57 | 425 | 150 | 52 | 5 | 30 | 1 | 0 | 201 | 25 | 30 | 8 | 0.3 |
| 62 | 7.43 | 1683 | 595 | 186 | 32 | 79 | 2 | 0 | 262 | 230 | 73 | 213 | 0.6 |
| 63 | 7.69 | 1965 | 480 | 84 | 66 | 184 | 19 | 0 | 397 | 280 | 158 | 93 | 0.8 |
| 64 | 7.74 | 651 | 235 | 58 | 22 | 48 | 1 | 0 | 305 | 39 | 33 | 33 | 0.6 |
| 65 | 8.02 | 369 | 120 | 22 | 16 | 47 | 0 | 0 | 201 | 25 | 15 | 23 | 0.9 |
| 66 | 7.75 | 2558 | 525 | 34 | 107 | 212 | 0 | 0 | 531 | 277 | 189 | 13 | 0.7 |
| 67 | 7.69 | 935 | 315 | 26 | 61 | 54 | 0 | 0 | 397 | 35 | 84 | 4 | 0.6 |
| 68 | 7.9 | 859 | 255 | 52 | 30 | 79 | 0 | 0 | 378 | 57 | 57 | 20 | 0.6 |
| 69 | 7.41 | 948 | 200 | 34 | 28 | 131 | 2 | 0 | 360 | 85 | 67 | 13 | 0.8 |
| 70 | 7.51 | 1958 | 410 | 92 | 44 | 233 | 2 | 0 | 439 | 248 | 223 | 61 | 0.9 |
| 71 | 7.45 | 1063 | 330 | 56 | 46 | 80 | 6 | 0 | 415 | 89 | 70 | 16 | 0.5 |
| 72 | 7.55 | 1058 | 265 | 52 | 33 | 80 | 49 | 0 | 409 | 64 | 57 | 52 | 0.5 |
| 73 | 7.52 | 859 | 280 | 100 | 7 | 70 | 0 | 0 | 458 | 32 | 42 | 9 | 0.6 |
| 74 | 7.76 | 1291 | 415 | 70 | 58 | 98 | 1 | 0 | 409 | 181 | 81 | 7 | 0.8 |
| 75 | 7.43 | 2899 | 980 | 275 | 72 | 152 | 34 | 0 | 311 | 454 | 505 | 31 | 0.5 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | μS/cm | <------------ mg/L ------------> | | | | | | | | | | |
| 76 | 7.49 | 3399 | 540 | 206 | 6 | 493 | 36 | 0 | 464 | 496 | 354 | 317 | 0.4 |
| 77 | 6.99 | 5060 | 1810 | 202 | 317 | 323 | 2 | 0 | 360 | 1368 | 450 | 19 | 0.7 |
| 78 | 7.4 | 1035 | 405 | 52 | 67 | 69 | 1 | 0 | 513 | 53 | 45 | 24 | 0.8 |
| 79 | 7.66 | 1099 | 350 | 52 | 53 | 74 | 1 | 0 | 299 | 117 | 64 | 80 | 0.6 |
| 80 | 7.66 | 1262 | 295 | 40 | 47 | 153 | 0 | 0 | 372 | 128 | 137 | 39 | 0.6 |
| 81 | 7.67 | 1140 | 210 | 38 | 28 | 150 | 4 | 0 | 336 | 142 | 86 | 29 | 0.5 |
| 82 | 7.48 | 1100 | 390 | 90 | 40 | 61 | 0 | 0 | 378 | 82 | 90 | 53 | 0.6 |
| 83 | 7.47 | 1106 | 330 | 54 | 47 | 95 | 2 | 0 | 476 | 71 | 57 | 47 | 0.7 |
| 84 | 7.36 | 898 | 350 | 88 | 32 | 50 | 1 | 0 | 238 | 46 | 234 | 1 | 0.5 |
| 85 | 7.6 | 4873 | 1430 | 317 | 156 | 456 | 3 | 0 | 354 | 879 | 957 | 35 | 0.3 |
| 86 | 7.5 | 8314 | 2560 | 541 | 294 | 729 | 5 | 0 | 372 | 1631 | 1600 | 79 | 0.3 |
| 87 | 7.49 | 3338 | 540 | 44 | 104 | 441 | 2 | 0 | 384 | 369 | 741 | 17 | 0.9 |
| 88 | 7.56 | 5646 | 1330 | 194 | 205 | 617 | 60 | 0 | 445 | 411 | 1460 | 29 | 0.8 |
| 89 | 7.46 | 1820 | 355 | 62 | 49 | 226 | 4 | 0 | 354 | 170 | 332 | 62 | 0.5 |
| 90 | 7.85 | 668 | 170 | 44 | 15 | 75 | 4 | 0 | 220 | 57 | 44 | 32 | 1.4 |
| 91 | 7.59 | 793 | 165 | 50 | 10 | 96 | 3 | 0 | 140 | 142 | 63 | 36 | 0.6 |
| 92 | 7.33 | 9603 | 2720 | 353 | 447 | 912 | 1 | 0 | 439 | 2311 | 1050 | 189 | 0.7 |
| 93 | 7.66 | 4747 | 1500 | 265 | 204 | 447 | 2 | 0 | 360 | 716 | 1232 | 44 | 0.6 |
| 94 | 7.39 | 559 | 205 | 50 | 19 | 61 | 1 | 0 | 299 | 35 | 32 | 8 | 0.4 |
| 95 | 7.55 | 541 | 145 | 44 | 9 | 71 | 1 | 0 | 238 | 39 | 37 | 6 | 0.8 |
| 96 | 7.77 | 2513 | 585 | 140 | 57 | 298 | 5 | 0 | 415 | 337 | 441 | 28 | 0.6 |
| 97 | 7.42 | 2295 | 635 | 112 | 86 | 201 | 1 | 0 | 421 | 262 | 403 | 42 | 0.5 |
| 98 | 7.22 | 1652 | 705 | 132 | 91 | 42 | 0 | 0 | 256 | 39 | 514 | 29 | 0.7 |
| 99 | 7.43 | 4029 | 1510 | 283 | 196 | 194 | 1 | 0 | 299 | 206 | 1255 | 45 | 0.7 |
| 100 | 7.45 | 1552 | 520 | 138 | 43 | 72 | 1 | 0 | 366 | 142 | 181 | 70 | 0.7 |
| 101 | 7.51 | 1159 | 230 | 60 | 19 | 119 | 2 | 0 | 207 | 188 | 65 | 27 | 1 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <--------------------- | | | | | | mg/L | ---------------> | | | |
| 102 | 7.15 | 652 | 190 | 38 | 23 | 63 | 1 | 0 | 336 | 25 | 32 | 12 | 0.8 |
| 103 | 7.5 | 984 | 235 | 64 | 18 | 115 | 2 | 0 | 207 | 181 | 65 | 27 | 1 |
| 104 | 7.55 | 967 | 385 | 102 | 32 | 35 | 0 | 0 | 348 | 82 | 76 | 20 | 0.5 |
| 105 | 7.49 | 1069 | 350 | 50 | 55 | 80 | 0 | 0 | 354 | 106 | 90 | 29 | 0.6 |
| 106 | 7.3 | 7581 | 2625 | 553 | 303 | 521 | 4 | 0 | 384 | 1418 | 1285 | 59 | 0.5 |
| 107 | 7.41 | 3961 | 1560 | 461 | 100 | 189 | 2 | 0 | 159 | 316 | 1309 | 75 | 0.6 |
| 108 | 7.65 | 628 | 130 | 32 | 12 | 100 | 1 | 0 | 366 | 25 | 17 | 30 | 0.8 |
| 109 | 7.36 | 552 | 255 | 66 | 22 | 30 | 1 | 0 | 336 | 28 | 15 | 16 | 0.9 |
| 110 | 7.36 | 1157 | 440 | 96 | 49 | 59 | 2 | 0 | 470 | 74 | 80 | 56 | 0.5 |
| 111 | 7.36 | 1088 | 345 | 82 | 34 | 77 | 4 | 0 | 403 | 96 | 79 | 9 | 0.5 |
| 112 | 7.72 | 807 | 300 | 70 | 30 | 45 | 0 | 0 | 384 | 25 | 52 | 32 | 0.9 |
| 113 | 7.54 | 653 | 240 | 46 | 30 | 40 | 1 | 0 | 311 | 21 | 41 | 33 | 0.6 |
| 114 | 7.57 | 785 | 315 | 58 | 41 | 50 | 1 | 0 | 336 | 74 | 51 | 33 | 0.6 |
| 115 | 7.49 | 752 | 300 | 70 | 30 | 45 | 2 | 0 | 360 | 53 | 42 | 25 | 0.7 |
| 116 | 7.35 | 1650 | 485 | 134 | 36 | 125 | 1 | 0 | 641 | 145 | 65 | 43 | 0.5 |
| 117 | 7.57 | 2101 | 510 | 44 | 97 | 204 | 37 | 0 | 659 | 262 | 121 | 53 | 0.6 |
| 118 | 7.55 | 2600 | 660 | 52 | 129 | 210 | 44 | 0 | 494 | 411 | 139 | 152 | 0.5 |
| 119 | 8.24 | 1201 | 260 | 32 | 44 | 204 | 2 | 36 | 445 | 35 | 154 | 1 | 0.9 |
| 120 | 7.2 | 2003 | 565 | 96 | 79 | 205 | 2 | 0 | 537 | 113 | 366 | 103 | 0.7 |
| 121 | 7.66 | 408 | 150 | 32 | 17 | 23 | 1 | 0 | 220 | 11 | 17 | 0 | 0.7 |
| 122 | 7.73 | 1080 | 360 | 34 | 67 | 110 | 0 | 0 | 391 | 138 | 102 | 43 | 0.4 |
| 123 | 7.59 | 2137 | 465 | 76 | 67 | 241 | 1 | 0 | 378 | 316 | 271 | 27 | 0.5 |
| 124 | 7.38 | 801 | 335 | 92 | 26 | 49 | 1 | 0 | 391 | 53 | 69 | 21 | 0.6 |
| 125 | 7.16 | 1907 | 480 | 132 | 36 | 181 | 3 | 0 | 403 | 213 | 259 | 71 | 0.7 |
| 126 | 7.94 | 1893 | 340 | 46 | 55 | 237 | 3 | 0 | 317 | 142 | 451 | 4 | 1.2 |
| 127 | 7.57 | 2560 | 625 | 184 | 40 | 307 | 4 | 0 | 281 | 312 | 696 | 20 | 0.7 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^-$ | $Cl^-$ | $SO_4^{2-}$ | $NO_3^-$ | $F^-$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------------ mg/L ------------------> | | | | | | | | | | |
| 128 | 7.36 | 2659 | 710 | 257 | 17 | 240 | 1 | 0 | 305 | 432 | 404 | 43 | 0.4 |
| 129 | 7.37 | 1459 | 470 | 116 | 44 | 92 | 1 | 0 | 323 | 206 | 169 | 4 | 0.5 |
| 130 | 7.53 | 768 | 280 | 54 | 35 | 36 | 15 | 0 | 366 | 35 | 34 | 26 | 0.8 |
| 131 | 7.6 | 951 | 290 | 48 | 41 | 79 | 0 | 0 | 397 | 89 | 36 | 18 | 0.6 |
| 132 | 7.48 | 854 | 320 | 100 | 17 | 38 | 1 | 0 | 336 | 57 | 62 | 18 | 0.7 |
| 133 | 7.41 | 2067 | 800 | 242 | 47 | 83 | 1 | 0 | 268 | 312 | 351 | 61 | 0.5 |
| 134 | 7.68 | 952 | 195 | 26 | 32 | 109 | 1 | 0 | 360 | 57 | 79 | 2 | 1.6 |
| 135 | 7.23 | 1015 | 245 | 58 | 24 | 73 | 2 | 0 | 262 | 117 | 50 | 6 | 0.9 |
| 136 | 7.67 | 1767 | 230 | 28 | 39 | 264 | 2 | 0 | 848 | 53 | 81 | 13 | 2.1 |
| 137 | 7.23 | 812 | 315 | 68 | 35 | 40 | 1 | 0 | 293 | 89 | 67 | 7 | 0.5 |
| 138 | 7.66 | 604 | 185 | 24 | 30 | 60 | 1 | 0 | 305 | 35 | 32 | 14 | 0.4 |
| 139 | 7.46 | 2977 | 640 | 88 | 102 | 336 | 1 | 0 | 439 | 567 | 262 | 70 | 0.5 |
| 140 | 7.37 | 949 | 400 | 88 | 44 | 30 | 0 | 0 | 378 | 60 | 66 | 50 | 0.5 |
| 141 | 7.4 | 1027 | 410 | 84 | 49 | 31 | 0 | 0 | 354 | 78 | 87 | 39 | 0.5 |
| 142 | 7.73 | 721 | 205 | 14 | 41 | 52 | 1 | 0 | 360 | 14 | 11 | 14 | 0.8 |
| 143 | 7.29 | 765 | 330 | 64 | 41 | 40 | 1 | 0 | 433 | 35 | 26 | 18 | 0.5 |
| 144 | 7.44 | 10256 | 2590 | 453 | 355 | 1061 | 3 | 0 | 549 | 1177 | 2998 | 80 | 1 |
| 145 | 7.61 | 2770 | 335 | 74 | 36 | 474 | 4 | 0 | 915 | 128 | 457 | 33 | 0.9 |
| 146 | 7.66 | 12130 | 3725 | 585 | 550 | 992 | 4 | 0 | 433 | 1652 | 2905 | 123 | 0.7 |
| 147 | 7.65 | 1529 | 400 | 60 | 61 | 169 | 2 | 0 | 586 | 78 | 200 | 59 | 0.8 |
| 148 | 7.38 | 4934 | 1865 | 347 | 243 | 237 | 1 | 0 | 311 | 1149 | 608 | 38 | 0.4 |
| 149 | 7.36 | 5305 | 2015 | 387 | 255 | 205 | 1 | 0 | 336 | 1177 | 624 | 37 | 0.4 |
| 150 | 7.27 | 7487 | 1740 | 164 | 323 | 931 | 3 | 0 | 549 | 1205 | 1453 | 75 | 1.3 |
| 151 | 8.06 | 1115 | 200 | 40 | 24 | 145 | 1 | 0 | 372 | 78 | 115 | 18 | 1.6 |
| 152 | 7.47 | 8003 | 2180 | 114 | 460 | 800 | 3 | 0 | 403 | 1397 | 1544 | 81 | 0.8 |
| 153 | 7.47 | 924 | 350 | 108 | 19 | 49 | 21 | 0 | 360 | 96 | 67 | 23 | 0.6 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------------ mg/L ------------------> | | | | | | | | | | |
| 154 | 7.88 | 530 | 125 | 28 | 13 | 65 | 1 | 0 | 250 | 28 | 35 | 7 | 0.7 |
| 155 | 7.12 | 1003 | 275 | 56 | 33 | 102 | 4 | 0 | 488 | 43 | 60 | 16 | 0.8 |
| 156 | 7.08 | 7006 | 3000 | 721 | 292 | 309 | 1 | 0 | 299 | 1432 | 1407 | 66 | 0.4 |
| 157 | 7.52 | 1048 | 280 | 86 | 16 | 102 | 11 | 0 | 305 | 60 | 116 | 37 | 0.5 |
| 158 | 7.53 | 2064 | 530 | 50 | 98 | 185 | 1 | 0 | 342 | 121 | 475 | 6 | 0.7 |
| 159 | 7.57 | 693 | 255 | 34 | 41 | 36 | 0 | 0 | 317 | 32 | 51 | 9 | 0.6 |
| 160 | 7.39 | 965 | 340 | 58 | 47 | 55 | 1 | 0 | 226 | 85 | 164 | 31 | 0.8 |
| 161 | 7.28 | 3291 | 1140 | 184 | 165 | 196 | 3 | 0 | 336 | 355 | 700 | 43 | 0.6 |
| 162 | 7.43 | 5814 | 1900 | 423 | 205 | 426 | 6 | 0 | 275 | 709 | 1369 | 205 | 0.7 |
| 163 | 7.65 | 1674 | 460 | 84 | 61 | 137 | 1 | 0 | 317 | 298 | 119 | 1 | 0.5 |
| 164 | 7.26 | 2493 | 860 | 102 | 147 | 123 | 2 | 0 | 336 | 468 | 268 | 31 | 0.4 |
| 165 | 7.53 | 802 | 370 | 120 | 17 | 30 | 0 | 0 | 305 | 82 | 56 | 39 | 0.7 |
| 166 | 7.48 | 849 | 335 | 116 | 11 | 33 | 1 | 0 | 268 | 82 | 72 | 34 | 0.7 |
| 167 | 7.5 | 1981 | 680 | 84 | 114 | 102 | 2 | 0 | 378 | 238 | 292 | 43 | 0.4 |
| 168 | 7.44 | 1317 | 325 | 126 | 2 | 114 | 2 | 0 | 189 | 177 | 154 | 45 | 1.4 |
| 169 | 7.66 | 1172 | 170 | 60 | 5 | 164 | 2 | 0 | 104 | 181 | 143 | 11 | 2.8 |
| 170 | 7.55 | 6377 | 1600 | 64 | 350 | 724 | 3 | 0 | 378 | 1347 | 1176 | 42 | 0.3 |
| 171 | 7.46 | 7720 | 2740 | 549 | 333 | 568 | 3 | 0 | 305 | 681 | 2330 | 44 | 0.7 |
| 172 | 7.31 | 908 | 350 | 90 | 30 | 60 | 6 | 0 | 391 | 57 | 89 | 18 | 0.9 |
| 173 | 7.29 | 596 | 240 | 62 | 21 | 53 | 1 | 0 | 317 | 43 | 37 | 22 | 0.8 |
| 174 | 7.5 | 2133 | 525 | 100 | 67 | 173 | 2 | 0 | 391 | 160 | 402 | 39 | 0.5 |
| 175 | 7.45 | 1453 | 335 | 40 | 57 | 105 | 1 | 0 | 415 | 71 | 153 | 16 | 0.6 |
| 176 | 7.74 | 720 | 115 | 28 | 11 | 109 | 1 | 0 | 268 | 53 | 59 | 27 | 0.8 |
| 177 | 7.54 | 1935 | 440 | 72 | 63 | 226 | 1 | 0 | 391 | 241 | 298 | 62 | 0.8 |
| 178 | 7.19 | 1946 | 705 | 174 | 66 | 108 | 1 | 0 | 360 | 337 | 189 | 53 | 0.4 |
| 179 | 7.33 | 2063 | 620 | 166 | 50 | 137 | 0 | 0 | 433 | 333 | 142 | 27 | 0.6 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------------ mg/L ----------------> | | | | | | | | | | |
| 180 | 7.53 | 1482 | 385 | 64 | 55 | 109 | 1 | 0 | 464 | 135 | 84 | 18 | 0.7 |
| 181 | 7.59 | 2042 | 760 | 196 | 66 | 83 | 1 | 0 | 317 | 191 | 433 | 52 | 0.6 |
| 182 | 7.34 | 3057 | 1045 | 339 | 49 | 195 | 4 | 0 | 293 | 599 | 439 | 80 | 0.7 |
| 183 | 7.82 | 1504 | 175 | 36 | 21 | 280 | 1 | 0 | 738 | 35 | 172 | 11 | 1.6 |
| 184 | 7.23 | 3624 | 755 | 162 | 85 | 418 | 5 | 0 | 403 | 652 | 476 | 98 | 0.5 |
| 185 | 7.07 | 2515 | 755 | 150 | 92 | 219 | 2 | 0 | 592 | 248 | 323 | 140 | 0.7 |
| 186 | 7.36 | 2255 | 550 | 186 | 21 | 222 | 3 | 0 | 268 | 337 | 303 | 117 | 0.7 |
| 187 | 7.57 | 1111 | 360 | 70 | 45 | 80 | 1 | 0 | 415 | 99 | 53 | 63 | 0.5 |
| 188 | 6.65 | 1567 | 575 | 184 | 28 | 83 | 1 | 0 | 232 | 213 | 240 | 85 | 0.9 |
| 189 | 7.64 | 735 | 245 | 52 | 28 | 51 | 0 | 0 | 330 | 46 | 36 | 4 | 0.7 |
| 190 | 7.5 | 720 | 250 | 46 | 33 | 41 | 1 | 0 | 305 | 50 | 35 | 13 | 0.7 |
| 191 | 7.68 | 1235 | 310 | 38 | 52 | 133 | 2 | 0 | 439 | 167 | 58 | 4 | 0.5 |
| 192 | 7.46 | 717 | 280 | 18 | 57 | 30 | 0 | 0 | 305 | 53 | 31 | 27 | 0.5 |
| 193 | 7.36 | 7285 | 1380 | 210 | 208 | 1018 | 5 | 0 | 452 | 986 | 1524 | 31 | 0.6 |
| 194 | 7.53 | 1718 | 650 | 136 | 75 | 92 | 2 | 0 | 244 | 57 | 596 | 37 | 1 |
| 195 | 7.61 | 4059 | 520 | 86 | 74 | 721 | 2 | 0 | 561 | 64 | 1579 | 32 | 0.9 |
| 196 | 7.27 | 888 | 250 | 72 | 17 | 92 | 1 | 0 | 427 | 50 | 39 | 7 | 0.9 |
| 197 | 7.64 | 1454 | 380 | 64 | 53 | 176 | 3 | 0 | 452 | 191 | 82 | 5 | 0.9 |
| 198 | 6.87 | 510 | 160 | 34 | 18 | 43 | 3 | 0 | 183 | 35 | 49 | 6 | 0.5 |
| 199 | 7.38 | 1442 | 315 | 48 | 47 | 166 | 1 | 0 | 403 | 195 | 93 | 29 | 1.5 |
| 200 | 7.51 | 1283 | 540 | 102 | 69 | 45 | 0 | 0 | 397 | 117 | 87 | 59 | 0.6 |
| 201 | 7.69 | 2125 | 385 | 84 | 43 | 199 | 125 | 0 | 427 | 312 | 197 | 50 | 0.8 |

**As per anexxure III (S. No.)*

## Annexure-VI

Major Ion Chemistry of Ground Water Samples from Shallow Aquifer (Aquifer-1), Post-monsoon Season-23.

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <---------------- | | | | | mg/L | | | | | ----------------> |
| 1 | 7.5 | 4639 | 1320 | 152 | 228 | 501 | 3 | 0 | 513 | 723 | 906 | 62 | 1.0 |
| 2 | 7.3 | 3599 | 940 | 44 | 202 | 398 | 3 | 0 | 574 | 496 | 689 | 72 | 1.2 |
| 3 | 7.27 | 5240 | 1820 | 341 | 236 | 349 | 2 | 0 | 433 | 993 | 544 | 124 | 0.9 |
| 4 | 7.86 | 1813 | 490 | 72 | 75 | 159 | 0 | 0 | 403 | 135 | 308 | 67 | 0.8 |
| 5 | 7.64 | 1462 | 555 | 110 | 68 | 67 | 1 | 0 | 476 | 128 | 91 | 92 | 0.2 |
| 6 | 7.75 | 2078 | 590 | 136 | 61 | 179 | 2 | 0 | 183 | 411 | 275 | 66 | 0.8 |
| 7 | 7.65 | 794 | 300 | 76 | 27 | 29 | 0 | 0 | 305 | 43 | 42 | 54 | 0.5 |
| 8 | 7.67 | 1282 | 530 | 140 | 44 | 40 | 1 | 0 | 433 | 99 | 61 | 89 | 0.4 |
| 9 | 7.73 | 7923 | 2290 | 397 | 316 | 732 | 2 | 0 | 323 | 1432 | 1666 | 40 | 0.4 |
| 10 | 7.98 | 7682 | 1400 | 253 | 187 | 1190 | 2 | 0 | 476 | 1418 | 1858 | 66 | 0.7 |
| 11 | 7.7 | 1046 | 350 | 58 | 50 | 58 | 0 | 0 | 366 | 71 | 63 | 68 | 0.5 |
| 12 | 7.31 | 1542 | 500 | 96 | 63 | 113 | 1 | 0 | 464 | 181 | 105 | 76 | 0.7 |
| 13 | 7.5 | 1400 | 585 | 134 | 61 | 49 | 0 | 0 | 330 | 149 | 117 | 74 | 0.5 |
| 14 | 7.46 | 4673 | 1400 | 357 | 124 | 465 | 2 | 0 | 293 | 709 | 1099 | 66 | 0.5 |
| 15 | 7.56 | 3918 | 1440 | 457 | 73 | 170 | 14 | 0 | 391 | 496 | 872 | 11 | 0.2 |
| 16 | 7.62 | 1845 | 580 | 86 | 89 | 108 | 1 | 0 | 342 | 248 | 155 | 101 | 0.3 |
| 17 | 7.62 | 2365 | 875 | 98 | 153 | 141 | 2 | 0 | 421 | 255 | 474 | 115 | 0.4 |
| 18 | 7.62 | 2567 | 730 | 124 | 102 | 259 | 2 | 0 | 427 | 454 | 293 | 17 | 0.4 |
| 19 | 7.5 | 1115 | 390 | 82 | 45 | 50 | 1 | 0 | 397 | 103 | 11 | 68 | 0.5 |
| 20 | 7.72 | 997 | 295 | 80 | 23 | 67 | 2 | 0 | 250 | 92 | 88 | 64 | 0.3 |
| 21 | 7.77 | 1785 | 465 | 96 | 55 | 134 | 11 | 0 | 360 | 220 | 129 | 96 | 0.6 |
| 22 | 7.56 | 785 | 310 | 58 | 40 | 37 | 0 | 0 | 360 | 50 | 53 | 0 | 0.3 |
| 23 | 7.73 | 1168 | 385 | 70 | 51 | 88 | 0 | 0 | 464 | 99 | 75 | 17 | 0.5 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <---------- mg/L ----------> | | | | | | | | | | |
| 24 | 7.65 | 1267 | 295 | 34 | 51 | 89 | 61 | 0 | 476 | 92 | 19 | 34 | 0.4 |
| 25 | 7.52 | 2993 | 1180 | 337 | 83 | 119 | 33 | 0 | 293 | 482 | 457 | 45 | 0.4 |
| 26 | 7.76 | 751 | 235 | 54 | 24 | 60 | 1 | 0 | 305 | 50 | 55 | 8 | 0.4 |
| 27 | 7.77 | 1227 | 400 | 80 | 49 | 70 | 1 | 0 | 360 | 113 | 83 | 65 | 0.4 |
| 28 | 7.82 | 935 | 210 | 36 | 29 | 115 | 1 | 0 | 330 | 71 | 92 | 7 | 0.5 |
| 29 | 7.75 | 1168 | 360 | 46 | 60 | 77 | 2 | 0 | 397 | 71 | 92 | 69 | 0.6 |
| 30 | 7.64 | 1033 | 355 | 66 | 46 | 53 | 1 | 0 | 262 | 43 | 212 | 25 | 0.2 |
| 31 | 7.83 | 5833 | 1530 | 285 | 199 | 653 | 3 | 0 | 378 | 1333 | 877 | 40 | 0.2 |
| 32 | 7.84 | 8056 | 2440 | 473 | 306 | 827 | 5 | 0 | 336 | 1801 | 1660 | 81 | 0.2 |
| 33 | 7.56 | 6863 | 1510 | 176 | 260 | 831 | 48 | 0 | 458 | 383 | 2378 | 34 | 1.0 |
| 34 | 7.64 | 6975 | 2050 | 253 | 345 | 721 | 3 | 0 | 445 | 1631 | 874 | 135 | 0.7 |
| 35 | 7.55 | 1282 | 415 | 110 | 34 | 104 | 2 | 0 | 427 | 156 | 90 | 53 | 0.4 |
| 36 | 7.9 | 822 | 280 | 46 | 40 | 65 | 2 | 0 | 238 | 71 | 107 | 24 | 0.3 |
| 37 | 7.47 | 3880 | 1520 | 325 | 173 | 215 | 1 | 0 | 305 | 284 | 1268 | 66 | 0.7 |
| 38 | 7.5 | 2250 | 770 | 200 | 66 | 99 | 44 | 0 | 299 | 177 | 495 | 64 | 0.4 |
| 39 | 7.61 | 7115 | 2290 | 465 | 275 | 453 | 2 | 0 | 336 | 1404 | 1251 | 42 | 0.3 |
| 40 | 7.43 | 3277 | 1360 | 345 | 122 | 127 | 1 | 0 | 275 | 298 | 901 | 81 | 0.6 |
| 41 | 7.25 | 1008 | 385 | 106 | 29 | 61 | 17 | 0 | 403 | 82 | 86 | 40 | 0.3 |
| 42 | 7.53 | 562 | 220 | 42 | 28 | 34 | 0 | 0 | 293 | 21 | 29 | 27 | 0.7 |
| 43 | 7.62 | 2315 | 515 | 52 | 94 | 224 | 41 | 0 | 616 | 298 | 135 | 109 | 0.7 |
| 44 | 7.27 | 2532 | 690 | 54 | 135 | 170 | 41 | 0 | 555 | 411 | 118 | 43 | 0.2 |
| 45 | 7.73 | 817 | 265 | 46 | 36 | 46 | 18 | 0 | 366 | 35 | 38 | 27 | 0.5 |
| 46 | 7.44 | 1718 | 335 | 48 | 52 | 207 | 2 | 0 | 330 | 128 | 331 | 13 | 1.0 |
| 47 | 7.4 | 2099 | 690 | 216 | 36 | 133 | 2 | 0 | 317 | 298 | 321 | 65 | 0.4 |
| 48 | 7.67 | 779 | 295 | 60 | 35 | 34 | 1 | 0 | 287 | 57 | 72 | 12 | 0.3 |
| 49 | 7.47 | 1562 | 645 | 180 | 47 | 41 | 0 | 0 | 275 | 213 | 189 | 77 | 0.3 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | μS/cm | <---------- mg/L ----------> | | | | | | | | | | |
| 50 | 7.78 | 892 | 320 | 42 | 52 | 45 | 1 | 0 | 360 | 60 | 45 | 26 | 0.7 |
| 51 | 7.71 | 1765 | 225 | 38 | 32 | 260 | 2 | 0 | 744 | 57 | 150 | 13 | 1.9 |
| 52 | 7.71 | 2815 | 545 | 84 | 81 | 325 | 2 | 0 | 336 | 553 | 199 | 69 | 0.5 |
| 53 | 7.42 | 803 | 305 | 54 | 41 | 31 | 0 | 0 | 348 | 57 | 10 | 22 | 0.5 |
| 54 | 7.63 | 716 | 245 | 50 | 29 | 39 | 0 | 0 | 323 | 21 | 23 | 45 | 0.4 |
| 55 | 7.66 | 9922 | 3620 | 481 | 588 | 810 | 4 | 0 | 366 | 978 | 3108 | 99 | 0.5 |
| 56 | 7.66 | 3036 | 900 | 116 | 148 | 252 | 3 | 0 | 445 | 213 | 602 | 88 | 0.8 |
| 57 | 7.75 | 8710 | 2920 | 240 | 564 | 874 | 3 | 0 | 452 | 553 | 3047 | 96 | 0.6 |
| 58 | 7.73 | 7420 | 1840 | 361 | 228 | 855 | 3 | 0 | 458 | 1163 | 1518 | 86 | 1.4 |
| 59 | 7.46 | 7846 | 2380 | 305 | 394 | 771 | 2 | 0 | 445 | 1248 | 1794 | 90 | 0.9 |
| 60 | 7.77 | 2476 | 820 | 162 | 101 | 136 | 1 | 0 | 336 | 262 | 510 | 28 | 0.3 |
| 61 | 7.64 | 5696 | 2180 | 677 | 119 | 291 | 1 | 0 | 226 | 1347 | 852 | 70 | 0.3 |
| 62 | 7.61 | 2587 | 945 | 283 | 58 | 160 | 4 | 0 | 330 | 284 | 680 | 34 | 0.7 |
| 63 | 7.36 | 1394 | 360 | 80 | 39 | 107 | 2 | 0 | 183 | 184 | 152 | 68 | 1.9 |
| 64 | 7.53 | 1284 | 225 | 62 | 17 | 134 | 2 | 0 | 128 | 206 | 137 | 22 | 2.6 |
| 65 | 7.69 | 2710 | 630 | 132 | 73 | 252 | 9 | 0 | 519 | 220 | 530 | 20 | 0.6 |
| 66 | 7.36 | 3422 | 960 | 216 | 102 | 325 | 3 | 0 | 360 | 312 | 898 | 9 | 0.5 |
| 67 | 7.65 | 1205 | 310 | 46 | 47 | 106 | 0 | 0 | 378 | 67 | 153 | 33 | 0.5 |
| 68 | 7.76 | 7601 | 2860 | 489 | 399 | 632 | 5 | 0 | 342 | 1262 | 2099 | 37 | 0.2 |
| 69 | 7.65 | 1623 | 495 | 88 | 67 | 112 | 1 | 0 | 494 | 163 | 145 | 26 | 0.5 |
| 70 | 7.36 | 1900 | 710 | 188 | 58 | 105 | 1 | 0 | 342 | 344 | 198 | 61 | 0.4 |
| 71 | 7.58 | 2270 | 860 | 224 | 73 | 104 | 1 | 0 | 323 | 277 | 382 | 125 | 0.3 |
| 72 | 7.4 | 2851 | 930 | 242 | 79 | 176 | 1 | 0 | 293 | 440 | 490 | 75 | 0.6 |
| 73 | 7.72 | 560 | 225 | 42 | 29 | 21 | 0 | 0 | 262 | 14 | 52 | 3 | 0.4 |
| 74 | 7.55 | 3767 | 1040 | 309 | 66 | 288 | 2 | 0 | 287 | 666 | 569 | 64 | 0.4 |
| 75 | 7.69 | 1814 | 470 | 118 | 43 | 143 | 1 | 0 | 445 | 234 | 113 | 48 | 1.3 |

| ID* | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | μS/cm | <--- mg/L ---> | | | | | | | | | | |
| 76 | 7.64 | 1696 | 415 | 104 | 38 | 144 | 40 | 0 | 445 | 177 | 147 | 66 | 0.6 |

***As per anexxure IV (S. No.)**

## Annexure-VII

Major Ion Chemistry of Ground Water Samples from Deeper Aquifer (Aquifer-2), Pre-monsoon Season-23.

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------ mg/L | | | | | | | | | ------------------------------> | |
| 1 | 7.78 | 1061 | 115 | 40 | 4 | 158 | 1 | 0 | 183 | 145 | 102 | 20 | 1.26 |
| 2 | 7.35 | 3146 | 1100 | 80 | 219 | 171 | 1 | 0 | 403 | 638 | 322 | 40 | 0.54 |
| 3 | 7.39 | 2494 | 830 | 68 | 160 | 145 | 1 | 0 | 476 | 425 | 216 | 36 | 0.52 |
| 4 | 7.51 | 2404 | 855 | 86 | 156 | 115 | 1 | 0 | 366 | 440 | 260 | 20 | 0.53 |
| 5 | 7.654 | 674 | 265 | 72 | 21 | 37 | 0 | 0 | 287 | 64 | 40 | 11 | 0.78 |
| 6 | 7.34 | 1415 | 580 | 134 | 60 | 41 | 0 | 0 | 336 | 177 | 158 | 54 | 0.61 |
| 7 | 7.53 | 3571 | 1080 | 84 | 211 | 254 | 2 | 0 | 488 | 624 | 162 | 78 | 0.89 |
| 8 | 7.57 | 5353 | 1250 | 82 | 254 | 591 | 4 | 0 | 683 | 723 | 992 | 33 | 0.91 |
| 9 | 7.64 | 1890 | 190 | 30 | 28 | 295 | 1 | 0 | 751 | 92 | 133 | 18 | 1.73 |
| 10 | 7.46 | 763 | 130 | 32 | 12 | 125 | 2 | 0 | 366 | 57 | 41 | 23 | 0.71 |
| 11 | 7.2 | 1702 | 295 | 52 | 40 | 220 | 14 | 0 | 244 | 234 | 311 | 13 | 1.01 |
| 12 | 7.77 | 754 | 230 | 56 | 22 | 82 | 1 | 0 | 323 | 53 | 63 | 43 | 1.18 |
| 13 | 7.24 | 1013 | 390 | 104 | 32 | 51 | 0 | 0 | 323 | 99 | 101 | 41 | 0.79 |
| 14 | 7.56 | 993 | 160 | 48 | 10 | 144 | 35 | 0 | 275 | 128 | 72 | 13 | 0.51 |
| 15 | 7.59 | 857 | 280 | 52 | 36 | 59 | 0 | 0 | 391 | 46 | 39 | 26 | 0.69 |
| 16 | 7.78 | 993 | 285 | 64 | 30 | 88 | 1 | 0 | 397 | 67 | 46 | 43 | 0.73 |
| 17 | 7.52 | 463 | 165 | 22 | 27 | 35 | 0 | 0 | 220 | 28 | 36 | 6 | 0.5 |
| 18 | 7.97 | 810 | 60 | 14 | 6 | 135 | 1 | 0 | 153 | 160 | 23 | 8 | 2.26 |
| 19 | 7.37 | 1495 | 235 | 40 | 33 | 129 | 112 | 0 | 555 | 103 | 56 | 71 | 0.46 |
| 20 | 7.29 | 1116 | 195 | 24 | 33 | 145 | 9 | 0 | 226 | 206 | 73 | 22 | 1.63 |
| 21 | 7.31 | 2996 | 760 | 172 | 80 | 286 | 2 | 0 | 146 | 581 | 509 | 20 | 1.25 |
| 22 | 7.3 | 7017 | 1940 | 573 | 124 | 582 | 2 | 0 | 226 | 1546 | 905 | 59 | 0.43 |
| 23 | 7.67 | 1014 | 135 | 50 | 2 | 171 | 7 | 0 | 397 | 74 | 58 | 73 | 0.35 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------ mg/L ------> | | | | | | | | | | |
| 24 | 7.53 | 625 | 165 | 48 | 11 | 78 | 0 | 0 | 238 | 85 | 35 | 11 | 0.57 |
| 25 | 7.47 | 622 | 165 | 40 | 16 | 69 | 1 | 0 | 244 | 53 | 28 | 38 | 0.69 |
| 26 | 7.48 | 572 | 220 | 68 | 12 | 34 | 3 | 0 | 299 | 25 | 31 | 6 | 0.48 |
| 27 | 7.124 | 11132 | 4080 | 717 | 556 | 693 | 2 | 0 | 476 | 2297 | 1709 | 320 | 0.47 |
| 28 | 7.414 | 1878 | 345 | 90 | 29 | 214 | 4 | 0 | 98 | 401 | 218 | 5 | 2.56 |
| 29 | 7.56 | 1027 | 210 | 22 | 38 | 131 | 0 | 0 | 348 | 106 | 56 | 58 | 0.5 |
| 30 | 7.27 | 1062 | 380 | 84 | 41 | 78 | 2 | 0 | 427 | 96 | 68 | 48 | 0.72 |
| 31 | 7.75 | 2199 | 360 | 112 | 19 | 306 | 3 | 0 | 165 | 319 | 484 | 15 | 2.11 |
| 32 | 7.54 | 874 | 290 | 32 | 51 | 61 | 0 | 0 | 366 | 46 | 47 | 46 | 0.62 |
| 33 | 7.69 | 902 | 305 | 36 | 52 | 65 | 0 | 0 | 421 | 46 | 60 | 6 | 0.69 |
| 34 | 7.3 | 2923 | 1140 | 365 | 56 | 149 | 1 | 0 | 348 | 461 | 621 | 32 | 0.31 |
| 35 | 7.86 | 1852 | 695 | 112 | 101 | 112 | 1 | 0 | 287 | 284 | 356 | 22 | 0.57 |
| 36 | 7.74 | 1797 | 365 | 100 | 28 | 205 | 6 | 0 | 299 | 213 | 250 | 81 | 0.62 |
| 37 | 7.16 | 1288 | 465 | 110 | 46 | 49 | 5 | 0 | 366 | 135 | 106 | 37 | 0.56 |
| 38 | 7.53 | 2719 | 830 | 76 | 156 | 210 | 7 | 0 | 592 | 326 | 157 | 224 | 0.94 |
| 39 | 7.502 | 2106 | 655 | 226 | 22 | 159 | 2 | 0 | 232 | 351 | 246 | 56 | 0.74 |
| 40 | 7.694 | 5472 | 1425 | 313 | 157 | 542 | 2 | 0 | 378 | 922 | 995 | 151 | 0.51 |
| 41 | 7.557 | 931 | 155 | 36 | 16 | 120 | 2 | 0 | 140 | 156 | 110 | 2 | 1.44 |
| 42 | 7.36 | 1351 | 295 | 74 | 27 | 156 | 2 | 0 | 409 | 131 | 101 | 46 | 0.56 |
| 43 | 7.08 | 997 | 310 | 70 | 33 | 86 | 1 | 0 | 384 | 92 | 81 | 4 | 0.48 |
| 44 | 8.14 | 506 | 135 | 38 | 10 | 66 | 1 | 0 | 262 | 21 | 15 | 13 | 0.48 |
| 45 | 7.25 | 2229 | 790 | 196 | 73 | 139 | 1 | 0 | 433 | 362 | 195 | 109 | 0.45 |
| 46 | 7.76 | 1148 | 200 | 32 | 29 | 119 | 1 | 0 | 268 | 117 | 81 | 41 | 0.41 |
| 47 | 7.67 | 1481 | 415 | 60 | 64 | 130 | 3 | 0 | 336 | 149 | 148 | 32 | 0.56 |
| 48 | 7.74 | 681 | 80 | 10 | 13 | 106 | 0 | 0 | 220 | 46 | 71 | 16 | 0.48 |
| 49 | 7.63 | 1155 | 280 | 52 | 36 | 97 | 1 | 0 | 336 | 103 | 71 | 43 | 0.39 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <---------- mg/L ----------> | | | | | | | | | | |
| 50 | 7.27 | 2729 | 845 | 168 | 103 | 231 | 6 | 0 | 586 | 269 | 532 | 28 | 0.66 |
| 51 | 7.24 | 3116 | 660 | 72 | 117 | 347 | 2 | 0 | 635 | 248 | 619 | 0 | 0.8 |
| 52 | 7.42 | 1128 | 295 | 64 | 33 | 118 | 1 | 0 | 525 | 46 | 67 | 33 | 1.2 |
| 53 | 7.139 | 1614 | 650 | 174 | 52 | 74 | 1 | 0 | 452 | 160 | 197 | 87 | 0.6 |
| 54 | 7.54 | 904 | 325 | 102 | 17 | 46 | 0 | 0 | 397 | 60 | 41 | 18 | 0.38 |
| 55 | 7.43 | 984 | 360 | 136 | 5 | 39 | 0 | 0 | 403 | 64 | 41 | 32 | 0.4 |
| 56 | 7.58 | 1088 | 180 | 54 | 11 | 140 | 1 | 0 | 275 | 124 | 77 | 55 | 0.47 |
| 57 | 7.49 | 1517 | 500 | 174 | 16 | 90 | 8 | 0 | 354 | 191 | 95 | 109 | 0.43 |
| 58 | 7.52 | 1052 | 385 | 36 | 72 | 52 | 0 | 0 | 330 | 96 | 70 | 54 | 0.48 |
| 59 | 7.39 | 1143 | 430 | 36 | 83 | 43 | 1 | 0 | 360 | 110 | 66 | 62 | 0.37 |
| 60 | 7.76 | 870 | 320 | 56 | 44 | 54 | 1 | 0 | 311 | 78 | 44 | 71 | 0.72 |
| 61 | 7.56 | 2451 | 630 | 120 | 80 | 214 | 6 | 0 | 330 | 408 | 200 | 130 | 0.61 |
| 62 | 7.47 | 998 | 325 | 88 | 26 | 69 | 1 | 0 | 336 | 99 | 53 | 51 | 0.58 |
| 63 | 7.847 | 971 | 175 | 40 | 18 | 142 | 2 | 0 | 342 | 78 | 104 | 33 | 0.79 |
| 64 | 7.5 | 1568 | 525 | 38 | 104 | 94 | 0 | 0 | 439 | 163 | 155 | 18 | 0.48 |
| 65 | 7.35 | 680 | 125 | 30 | 12 | 110 | 1 | 0 | 281 | 78 | 45 | 2 | 1.53 |
| 66 | 8.31 | 541 | 90 | 18 | 11 | 89 | 0 | 18 | 61 | 103 | 58 | 5 | 0.7 |
| 67 | 7.846 | 529 | 150 | 42 | 11 | 63 | 1 | 0 | 195 | 57 | 41 | 32 | 1.28 |
| 68 | 7.44 | 1501 | 475 | 100 | 55 | 90 | 10 | 0 | 452 | 167 | 108 | 36 | 0.48 |
| 69 | 7.45 | 1078 | 335 | 70 | 39 | 78 | 0 | 0 | 397 | 92 | 64 | 26 | 0.43 |
| 70 | 7.52 | 683 | 180 | 58 | 9 | 66 | 0 | 0 | 317 | 28 | 44 | 8 | 0.41 |
| 71 | 7.62 | 707 | 135 | 38 | 10 | 95 | 3 | 0 | 348 | 28 | 28 | 14 | 0.38 |
| 72 | 7.6 | 626 | 225 | 48 | 26 | 51 | 1 | 0 | 305 | 35 | 49 | 18 | 0.8 |
| 73 | 7.3 | 1313 | 400 | 86 | 45 | 141 | 26 | 0 | 635 | 96 | 63 | 33 | 0.58 |
| 74 | 7.43 | 6589 | 1870 | 501 | 151 | 589 | 5 | 0 | 220 | 1276 | 1087 | 3 | 0.48 |
| 75 | 7.38 | 1895 | 500 | 102 | 60 | 168 | 2 | 0 | 348 | 277 | 250 | 17 | 0.58 |

| ID | pH | EC µS/cm | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | <------------ mg/L ------------> | | | | | | | | | | |
| 76 | 7.41 | 1186 | 285 | 86 | 17 | 99 | 2 | 0 | 342 | 99 | 65 | 61 | 0.77 |
| 77 | 7.62 | 647 | 110 | 16 | 17 | 81 | 1 | 0 | 98 | 92 | 83 | 4 | 1.2 |
| 78 | 7.56 | 1179 | 300 | 84 | 22 | 106 | 1 | 0 | 366 | 106 | 87 | 41 | 0.38 |
| 79 | 7.3 | 2069 | 750 | 112 | 114 | 99 | 1 | 0 | 348 | 259 | 345 | 51 | 0.57 |
| 80 | 7.42 | 746 | 220 | 70 | 11 | 69 | 1 | 0 | 342 | 46 | 36 | 18 | 0.66 |
| 81 | 7.57 | 703 | 140 | 44 | 7 | 96 | 1 | 0 | 317 | 39 | 42 | 10 | 0.58 |
| 82 | 7.37 | 1009 | 395 | 72 | 52 | 56 | 1 | 0 | 372 | 106 | 55 | 43 | 0.57 |
| 83 | 7.44 | 3969 | 950 | 214 | 101 | 392 | 41 | 0 | 519 | 447 | 710 | 130 | 0.7 |
| 84 | 7.51 | 906 | 340 | 100 | 22 | 54 | 1 | 0 | 311 | 96 | 79 | 28 | 0.56 |
| 85 | 7.81 | 2822 | 470 | 110 | 47 | 398 | 8 | 0 | 366 | 489 | 441 | 19 | 1.8 |
| 86 | 7.08 | 3597 | 800 | 78 | 147 | 375 | 2 | 0 | 470 | 326 | 874 | 23 | 1.04 |
| 87 | 7.53 | 2286 | 565 | 118 | 66 | 238 | 2 | 0 | 268 | 128 | 707 | 25 | 0.64 |
| 88 | 7.45 | 460 | 85 | 14 | 12 | 63 | 0 | 0 | 207 | 28 | 22 | 4 | 0.65 |
| 89 | 7.13 | 4080 | 890 | 62 | 179 | 471 | 2 | 0 | 513 | 574 | 776 | 32 | 0.8 |
| 90 | 7.54 | 1285 | 475 | 178 | 7 | 56 | 0 | 0 | 433 | 113 | 84 | 55 | 0.61 |
| 91 | 7.28 | 1296 | 410 | 120 | 27 | 77 | 0 | 0 | 348 | 138 | 93 | 66 | 0.54 |
| 92 | 7.76 | 1283 | 155 | 38 | 15 | 191 | 4 | 0 | 384 | 128 | 90 | 37 | 0.66 |
| 93 | 7.44 | 10850 | 2040 | 216 | 365 | 1367 | 1 | 0 | 683 | 2524 | 1007 | 251 | 0.5 |
| 94 | 7.59 | 2273 | 520 | 136 | 44 | 222 | 1 | 0 | 122 | 525 | 235 | 4 | 0.59 |
| 95 | 7.48 | 834 | 195 | 54 | 15 | 98 | 1 | 0 | 336 | 67 | 50 | 28 | 0.81 |
| 96 | 7.46 | 1223 | 435 | 134 | 24 | 60 | 0 | 0 | 293 | 124 | 161 | 35 | 0.7 |
| 97 | 7.82 | 856 | 120 | 38 | 6 | 148 | 2 | 0 | 153 | 152 | 61 | 3 | 0.92 |
| 98 | 7.91 | 590 | 80 | 22 | 6 | 107 | 1 | 0 | 311 | 39 | 25 | 3 | 0.53 |
| 99 | 7.52 | 1084 | 265 | 34 | 44 | 108 | 1 | 0 | 305 | 117 | 107 | 8 | 0.89 |
| 100 | 7.32 | 3269 | 870 | 287 | 38 | 282 | 14 | 0 | 409 | 482 | 524 | 88 | 0.6 |
| 101 | 7.29 | 822 | 290 | 66 | 30 | 67 | 1 | 0 | 323 | 57 | 92 | 31 | 0.54 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | μS/cm | <------------------------ mg/L ------------------------> | | | | | | | | | | |
| 102 | 7.45 | 1010 | 315 | 36 | 55 | 80 | 2 | 0 | 342 | 74 | 96 | 53 | 0.56 |
| 103 | 7.25 | 2768 | 745 | 148 | 91 | 243 | 3 | 0 | 391 | 468 | 302 | 119 | 0.45 |
| 104 | 7.21 | 2840 | 825 | 224 | 64 | 202 | 2 | 0 | 391 | 479 | 305 | 92 | 0.56 |
| 105 | 7.13 | 3596 | 1215 | 277 | 128 | 183 | 4 | 0 | 348 | 748 | 312 | 112 | 0.4 |
| 106 | 7.57 | 1961 | 550 | 62 | 96 | 163 | 1 | 0 | 348 | 121 | 502 | 2 | 0.56 |
| 107 | 7.26 | 3858 | 1130 | 128 | 197 | 325 | 2 | 0 | 79 | 567 | 920 | 0 | 0.31 |
| 108 | 7.52 | 713 | 160 | 48 | 10 | 87 | 1 | 0 | 268 | 57 | 55 | 26 | 0.79 |
| 109 | 7.66 | 924 | 380 | 80 | 44 | 37 | 0 | 0 | 317 | 89 | 83 | 22 | 0.51 |
| 110 | 7.76 | 1164 | 325 | 78 | 32 | 113 | 1 | 0 | 268 | 142 | 165 | 1 | 2.04 |
| 111 | 7.7 | 1389 | 275 | 96 | 9 | 188 | 2 | 0 | 372 | 163 | 176 | 33 | 0.47 |
| 112 | 7.24 | 876 | 100 | 22 | 11 | 138 | 2 | 0 | 104 | 177 | 87 | 4 | 3.9 |
| 113 | 7.41 | 1072 | 375 | 72 | 47 | 54 | 8 | 0 | 384 | 71 | 78 | 53 | 0.5 |
| 114 | 7.46 | 959 | 380 | 94 | 35 | 39 | 2 | 0 | 366 | 74 | 70 | 37 | 0.51 |
| 115 | 7.54 | 460 | 120 | 26 | 13 | 68 | 1 | 0 | 250 | 25 | 42 | 7 | 0.96 |
| 116 | 7.7 | 687 | 125 | 42 | 5 | 96 | 1 | 0 | 317 | 32 | 33 | 25 | 0.64 |
| 117 | 7.44 | 950 | 255 | 84 | 11 | 91 | 1 | 0 | 293 | 103 | 80 | 30 | 0.53 |
| 118 | 7.6 | 810 | 235 | 54 | 24 | 76 | 1 | 0 | 262 | 89 | 42 | 56 | 0.87 |
| 119 | 7.78 | 645 | 120 | 30 | 11 | 105 | 0 | 0 | 262 | 57 | 63 | 23 | 0.74 |
| 120 | 7.13 | 1122 | 225 | 22 | 41 | 135 | 4 | 0 | 299 | 142 | 64 | 59 | 1.38 |
| 121 | 7.72 | 2489 | 490 | 64 | 80 | 301 | 2 | 0 | 586 | 418 | 148 | 46 | 0.77 |
| 122 | 7.64 | 738 | 200 | 58 | 13 | 96 | 1 | 0 | 323 | 43 | 38 | 25 | 0.86 |
| 123 | 7.924 | 702 | 85 | 14 | 12 | 111 | 1 | 0 | 189 | 85 | 58 | 21 | 1.8 |
| 124 | 7.699 | 934 | 230 | 60 | 19 | 104 | 1 | 0 | 348 | 71 | 85 | 29 | 0.72 |
| 125 | 7.19 | 2539 | 680 | 52 | 134 | 224 | 2 | 0 | 580 | 216 | 429 | 53 | 0.83 |
| 126 | 7 | 4010 | 1055 | 261 | 98 | 398 | 3 | 0 | 98 | 1163 | 290 | 11 | 0.23 |
| 127 | 7.113 | 2016 | 605 | 112 | 79 | 207 | 2 | 0 | 513 | 121 | 450 | 102 | 0.66 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------ mg/L ------> | | | | | | | | | | |
| 128 | 7.383 | 2756 | 695 | 176 | 62 | 330 | 4 | 0 | 592 | 312 | 457 | 116 | 0.55 |
| 129 | 7.656 | 1599 | 430 | 78 | 57 | 190 | 2 | 0 | 702 | 71 | 197 | 34 | 0.73 |
| 130 | 7.56 | 628 | 165 | 38 | 17 | 71 | 1 | 0 | 287 | 35 | 39 | 21 | 0.51 |
| 131 | 7.32 | 1395 | 540 | 164 | 32 | 86 | 1 | 0 | 397 | 78 | 306 | 44 | 0.69 |
| 132 | 7.86 | 730 | 160 | 38 | 16 | 98 | 1 | 0 | 336 | 46 | 45 | 21 | 0.69 |
| 133 | 7.66 | 701 | 235 | 38 | 34 | 50 | 2 | 0 | 317 | 43 | 47 | 10 | 0.65 |
| 134 | 7.85 | 858 | 300 | 44 | 46 | 49 | 1 | 0 | 384 | 46 | 51 | 17 | 0.63 |
| 135 | 7.43 | 1491 | 385 | 42 | 68 | 115 | 1 | 0 | 342 | 149 | 161 | 51 | 0.45 |
| 136 | 7.521 | 1501 | 445 | 118 | 36 | 113 | 1 | 0 | 262 | 230 | 176 | 33 | 0.61 |
| 137 | 7.46 | 1011 | 320 | 98 | 18 | 90 | 0 | 0 | 366 | 106 | 68 | 56 | 1.09 |
| 138 | 7.54 | 997 | 235 | 62 | 19 | 105 | 1 | 0 | 201 | 163 | 81 | 19 | 0.69 |
| 139 | 7.45 | 1828 | 445 | 124 | 33 | 180 | 3 | 0 | 464 | 184 | 221 | 51 | 0.86 |
| 140 | 7.27 | 2240 | 520 | 120 | 53 | 244 | 2 | 0 | 427 | 294 | 323 | 44 | 0.67 |
| 141 | 7.22 | 1999 | 425 | 120 | 30 | 224 | 2 | 0 | 110 | 280 | 481 | 9 | 0.85 |
| 142 | 7.24 | 1796 | 410 | 124 | 24 | 196 | 2 | 0 | 293 | 308 | 200 | 37 | 0.51 |
| 143 | 7.62 | 3676 | 710 | 118 | 101 | 510 | 3 | 0 | 470 | 184 | 1258 | 46 | 1.46 |
| 144 | 7.66 | 1623 | 290 | 56 | 36 | 198 | 2 | 0 | 275 | 248 | 186 | 24 | 0.72 |
| 145 | 7.81 | 936 | 110 | 26 | 11 | 110 | 61 | 0 | 268 | 78 | 113 | 17 | 0.76 |
| 146 | 7.56 | 1042 | 360 | 88 | 34 | 91 | 5 | 0 | 409 | 96 | 66 | 46 | 0.52 |
| 147 | 7.469 | 1741 | 635 | 216 | 23 | 77 | 1 | 0 | 250 | 277 | 224 | 50 | 0.58 |
| 148 | 7.294 | 2451 | 680 | 218 | 33 | 217 | 4 | 0 | 140 | 447 | 490 | 7 | 1.71 |
| 149 | 7.65 | 1402 | 400 | 36 | 75 | 85 | 1 | 0 | 360 | 145 | 115 | 22 | 0.64 |
| 150 | 7.34 | 1344 | 405 | 76 | 52 | 66 | 0 | 0 | 323 | 152 | 107 | 12 | 0.67 |
| 151 | 7.08 | 1242 | 235 | 44 | 30 | 158 | 2 | 0 | 183 | 227 | 98 | 10 | 2.17 |
| 152 | 7.69 | 664 | 180 | 38 | 21 | 63 | 1 | 0 | 195 | 74 | 41 | 41 | 0.69 |
| 153 | 7.67 | 850 | 230 | 54 | 23 | 75 | 1 | 0 | 250 | 96 | 51 | 37 | 0.89 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------ mg/L ------------> | | | | | | | | | | |
| 154 | 7.85 | 2019 | 670 | 198 | 43 | 113 | 1 | 0 | 378 | 372 | 119 | 50 | 0.55 |
| 155 | 7.54 | 927 | 370 | 94 | 33 | 29 | 0 | 0 | 342 | 64 | 64 | 42 | 0.49 |
| 156 | 7.5 | 346 | 100 | 20 | 12 | 38 | 0 | 0 | 122 | 35 | 25 | 3 | 0.78 |
| 157 | 7.79 | 677 | 75 | 24 | 4 | 102 | 1 | 0 | 98 | 121 | 55 | 0 | 2.72 |
| 158 | 7.42 | 757 | 320 | 38 | 55 | 43 | 0 | 0 | 421 | 32 | 36 | 18 | 0.55 |
| 159 | 7.49 | 578 | 235 | 52 | 26 | 42 | 1 | 0 | 342 | 25 | 24 | 0 | 0.47 |
| 160 | 7.41 | 879 | 335 | 42 | 56 | 41 | 0 | 0 | 372 | 53 | 24 | 9 | 0.57 |
| 161 | 7.42 | 811 | 290 | 42 | 45 | 58 | 2 | 0 | 336 | 50 | 30 | 16 | 0.57 |
| 162 | 7.31 | 9780 | 2740 | 393 | 428 | 991 | 3 | 0 | 641 | 1092 | 2572 | 61 | 1 |
| 163 | 7.61 | 4922 | 1330 | 220 | 190 | 448 | 2 | 0 | 250 | 1141 | 632 | 44 | 0.98 |
| 164 | 7.46 | 2035 | 540 | 54 | 98 | 219 | 2 | 0 | 458 | 291 | 182 | 44 | 1.55 |
| 165 | 7.52 | 11100 | 3100 | 289 | 578 | 1115 | 4 | 0 | 976 | 1560 | 2081 | 88 | 1.14 |
| 166 | 7.59 | 883 | 270 | 72 | 22 | 70 | 3 | 0 | 397 | 43 | 64 | 13 | 0.43 |
| 167 | 7.6 | 2358 | 405 | 132 | 18 | 320 | 4 | 0 | 201 | 326 | 539 | 33 | 1.6 |
| 168 | 7.65 | 1287 | 310 | 22 | 62 | 100 | 2 | 0 | 403 | 71 | 135 | 1 | 0.72 |
| 169 | 7.62 | 1281 | 470 | 40 | 90 | 52 | 0 | 0 | 354 | 89 | 165 | 13 | 0.81 |
| 170 | 7.24 | 5215 | 1240 | 184 | 190 | 624 | 3 | 0 | 452 | 326 | 1605 | 11 | 0.92 |
| 171 | 7.57 | 1442 | 480 | 82 | 67 | 56 | 1 | 0 | 323 | 128 | 161 | 34 | 0.7 |
| 172 | 7.48 | 1459 | 305 | 76 | 28 | 95 | 1 | 0 | 317 | 92 | 155 | 4 | 0.71 |
| 173 | 7.81 | 2172 | 460 | 64 | 73 | 263 | 1 | 0 | 580 | 333 | 168 | 4 | 0.66 |
| 174 | 7.59 | 1711 | 375 | 70 | 49 | 165 | 47 | 0 | 519 | 206 | 114 | 32 | 0.58 |
| 175 | 7.54 | 2509 | 605 | 76 | 101 | 221 | 69 | 0 | 549 | 333 | 214 | 117 | 0.69 |
| 176 | 7.68 | 1637 | 470 | 62 | 77 | 133 | 2 | 0 | 311 | 298 | 134 | 3 | 0.47 |
| 177 | 7.69 | 904 | 220 | 58 | 18 | 111 | 1 | 0 | 183 | 142 | 84 | 22 | 0.7 |
| 178 | 7.42 | 3196 | 725 | 138 | 92 | 332 | 4 | 0 | 287 | 411 | 702 | 40 | 0.99 |
| 179 | 7.41 | 2124 | 590 | 70 | 101 | 160 | 1 | 0 | 299 | 287 | 316 | 43 | 0.5 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <---------- mg/L ----------> | | | | | | | | | | |
| 180 | 7.16 | 1622 | 455 | 132 | 30 | 116 | 1 | 0 | 281 | 241 | 123 | 79 | 0.7 |
| 181 | 7.2 | 4153 | 1150 | 76 | 233 | 328 | 4 | 0 | 348 | 826 | 533 | 35 | 0.37 |
| 182 | 7.15 | 3667 | 1400 | 128 | 262 | 126 | 0 | 0 | 409 | 730 | 413 | 37 | 0.33 |
| 183 | 7.26 | 5707 | 1800 | 124 | 362 | 466 | 2 | 0 | 348 | 1241 | 800 | 110 | 0.29 |
| 184 | 7.63 | 2200 | 590 | 208 | 17 | 206 | 4 | 0 | 183 | 291 | 512 | 41 | 1.85 |
| 185 | 7.335 | 488 | 95 | 14 | 15 | 89 | 1 | 0 | 201 | 60 | 49 | 13 | 1.28 |
| 186 | 7.774 | 702 | 125 | 16 | 21 | 112 | 1 | 0 | 171 | 131 | 58 | 9 | 2.16 |
| 187 | 7.4 | 1005 | 250 | 70 | 18 | 120 | 1 | 0 | 317 | 142 | 80 | 13 | 0.49 |
| 188 | 8.14 | 643 | 60 | 8 | 10 | 103 | 5 | 0 | 226 | 28 | 80 | 0 | 0.58 |
| 189 | 7.47 | 1850 | 505 | 138 | 39 | 136 | 1 | 0 | 342 | 135 | 355 | 49 | 0.59 |
| 190 | 7.7 | 1766 | 410 | 60 | 63 | 152 | 1 | 0 | 256 | 121 | 376 | 34 | 0.58 |
| 191 | 7.65 | 978 | 300 | 48 | 44 | 69 | 0 | 0 | 415 | 39 | 68 | 21 | 0.55 |
| 192 | 7.66 | 5201 | 1420 | 216 | 214 | 608 | 3 | 0 | 384 | 525 | 1549 | 62 | 1.17 |
| 193 | 7.89 | 4652 | 1000 | 212 | 114 | 524 | 3 | 0 | 238 | 716 | 943 | 33 | 2.2 |
| 194 | 7.89 | 712 | 105 | 10 | 19 | 100 | 1 | 0 | 104 | 128 | 69 | 8 | 2.45 |
| 195 | 7.6 | 815 | 270 | 72 | 22 | 50 | 0 | 0 | 330 | 53 | 56 | 7 | 0.68 |
| 196 | 7.31 | 2046 | 520 | 118 | 55 | 188 | 1 | 0 | 409 | 330 | 173 | 41 | 0.65 |
| 197 | 7.46 | 1348 | 555 | 130 | 56 | 42 | 0 | 0 | 232 | 269 | 119 | 12 | 0.62 |
| 198 | 7.73 | 1087 | 340 | 56 | 49 | 95 | 0 | 0 | 433 | 82 | 85 | 30 | 0.75 |
| 199 | 7.62 | 1505 | 290 | 86 | 18 | 192 | 1 | 0 | 146 | 199 | 348 | 9 | 0.92 |
| 200 | 7.283 | 1224 | 450 | 150 | 18 | 56 | 1 | 0 | 317 | 145 | 142 | 13 | 0.61 |
| 201 | 7.893 | 2313 | 155 | 24 | 23 | 506 | 2 | 0 | 1141 | 121 | 149 | 76 | 2.1 |
| 202 | 7.385 | 2135 | 605 | 200 | 26 | 180 | 4 | 0 | 134 | 408 | 368 | 11 | 1.55 |
| 203 | 7.719 | 1402 | 225 | 66 | 15 | 171 | 2 | 0 | 122 | 294 | 125 | 5 | 1.82 |
| 204 | 9.03 | 1531 | 125 | 20 | 18 | 260 | 2 | 99 | 287 | 128 | 93 | 15 | 1.46 |
| 205 | 7.13 | 2217 | 645 | 190 | 41 | 179 | 6 | 0 | 458 | 248 | 294 | 100 | 1 |

| ID | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^+$ | $K^+$ | $CO_3^{2-}$ | $HCO_3^-$ | $Cl^-$ | $SO_4^{2-}$ | $NO_3^-$ | $F^-$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------------------ mg/L | | | | | | | | | ------------------------------------------> | |
| 206 | 7.267 | 2108 | 640 | 174 | 50 | 164 | 26 | 0 | 537 | 213 | 272 | 104 | 0.86 |
| 207 | 7.49 | 1289 | 210 | 40 | 27 | 162 | 1 | 0 | 153 | 241 | 119 | 12 | 1.73 |
| 208 | 7.492 | 2104 | 465 | 162 | 15 | 293 | 5 | 0 | 244 | 184 | 715 | 16 | 0.57 |
| 209 | 7.042 | 2319 | 940 | 190 | 113 | 143 | 4 | 0 | 403 | 298 | 493 | 63 | 0.64 |
| 210 | 7.05 | 2510 | 810 | 146 | 108 | 223 | 2 | 0 | 586 | 248 | 405 | 126 | 0.67 |
| 211 | 7.26 | 1007 | 290 | 78 | 23 | 99 | 2 | 0 | 384 | 60 | 70 | 81 | 0.83 |
| 212 | 7.577 | 1759 | 675 | 224 | 28 | 58 | 1 | 0 | 244 | 291 | 181 | 93 | 0.45 |
| 213 | 8.001 | 573 | 135 | 14 | 24 | 97 | 1 | 0 | 183 | 78 | 93 | 1 | 1.41 |
| 214 | 7.42 | 986 | 275 | 48 | 38 | 79 | 4 | 0 | 360 | 89 | 39 | 40 | 0.39 |
| 215 | 7.25 | 974 | 315 | 58 | 41 | 63 | 0 | 0 | 348 | 82 | 62 | 40 | 0.52 |
| 216 | 7.47 | 1079 | 325 | 54 | 46 | 75 | 10 | 0 | 354 | 96 | 69 | 56 | 0.56 |
| 217 | 7.58 | 832 | 200 | 30 | 30 | 95 | 1 | 0 | 348 | 74 | 41 | 6 | 0.43 |
| 218 | 7.43 | 3075 | 550 | 196 | 15 | 400 | 12 | 0 | 427 | 337 | 612 | 81 | 0.71 |
| 219 | 7.53 | 2093 | 685 | 170 | 63 | 138 | 1 | 0 | 305 | 113 | 601 | 42 | 0.78 |
| 220 | 7.37 | 1174 | 340 | 58 | 47 | 72 | 1 | 0 | 403 | 71 | 38 | 41 | 0.89 |
| 221 | 7.85 | 891 | 180 | 66 | 4 | 150 | 2 | 0 | 421 | 96 | 47 | 1 | 0.82 |
| 222 | 7.36 | 630 | 165 | 42 | 15 | 70 | 1 | 0 | 171 | 89 | 63 | 9 | 1.43 |
| 223 | 7.61 | 774 | 280 | 48 | 39 | 45 | 1 | 0 | 342 | 50 | 42 | 16 | 0.7 |

## Annexure-VIII

Major Ion Chemistry of Ground Water Samples from Deeper Aquifer (Aquifer-2), Post-monsoon Season-23.

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------- mg/L -------------------------> | | | | | | | | | | |
| 1 | 7.61 | 1396 | 170 | 48 | 12 | 196 | 1 | 0 | 299 | 149 | 154 | 40 | 0.5 |
| 2 | 7.49 | 2000 | 830 | 236 | 58 | 66 | 0 | 0 | 293 | 397 | 205 | 44 | 0.4 |
| 3 | 7.35 | 3099 | 1010 | 152 | 153 | 255 | 4 | 0 | 397 | 596 | 345 | 58 | 1 |
| 4 | 7.5 | 4639 | 1320 | 152 | 228 | 501 | 3 | 0 | 513 | 723 | 906 | 62 | 1 |
| 5 | 7.3 | 3599 | 940 | 44 | 202 | 398 | 3 | 0 | 574 | 496 | 689 | 72 | 1.2 |
| 6 | 7.64 | 1703 | 210 | 42 | 26 | 287 | 1 | 0 | 696 | 99 | 159 | 15 | 1.7 |
| 7 | 7.27 | 5240 | 1820 | 341 | 236 | 349 | 2 | 0 | 433 | 993 | 544 | 124 | 0.9 |
| 8 | 7.86 | 1813 | 490 | 72 | 75 | 159 | 0 | 0 | 403 | 135 | 308 | 67 | 0.8 |
| 9 | 8.13 | 418 | 25 | 6 | 2 | 75 | 0 | 0 | 104 | 50 | 40 | 8 | 1.2 |
| 10 | 7.64 | 1462 | 555 | 110 | 68 | 67 | 1 | 0 | 476 | 128 | 91 | 92 | 0.2 |
| 11 | 8.26 | 525 | 50 | 10 | 6 | 102 | 1 | 0 | 201 | 60 | 12 | 11 | 2.1 |
| 12 | 7.29 | 1188 | 325 | 44 | 52 | 100 | 18 | 0 | 500 | 106 | 19 | 37 | 0.3 |
| 13 | 7.63 | 1179 | 265 | 58 | 29 | 113 | 15 | 0 | 311 | 163 | 44 | 55 | 1.1 |
| 14 | 7.49 | 3197 | 810 | 232 | 56 | 300 | 6 | 0 | 226 | 695 | 324 | 88 | 0.9 |
| 15 | 7.75 | 2078 | 590 | 136 | 61 | 179 | 2 | 0 | 183 | 411 | 275 | 66 | 0.8 |
| 16 | 7.32 | 1280 | 380 | 56 | 58 | 97 | 1 | 0 | 391 | 145 | 62 | 59 | 0.5 |
| 17 | 7.58 | 941 | 180 | 48 | 15 | 121 | 14 | 0 | 354 | 89 | 4 | 42 | 0.3 |
| 18 | 7.47 | 1242 | 350 | 42 | 60 | 94 | 1 | 0 | 384 | 85 | 68 | 119 | 0.5 |
| 19 | 7.65 | 794 | 300 | 76 | 27 | 29 | 0 | 0 | 305 | 43 | 42 | 54 | 0.5 |
| 20 | 7.67 | 1282 | 530 | 140 | 44 | 40 | 1 | 0 | 433 | 99 | 61 | 89 | 0.4 |
| 21 | 7.49 | 14180 | 5080 | 890 | 695 | 1002 | 2 | 0 | 360 | 3261 | 2321 | 26 | 0.2 |
| 22 | 7.73 | 7923 | 2290 | 397 | 316 | 732 | 2 | 0 | 323 | 1432 | 1666 | 40 | 0.4 |
| 23 | 7.7 | 5859 | 2000 | 533 | 163 | 447 | 3 | 0 | 415 | 1475 | 699 | 95 | 0.4 |

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | μS/cm | <------------------------------ mg/L ------------------------------> | | | | | | | | | | |
| 24 | 8.03 | 640 | 120 | 22 | 16 | 95 | 1 | 0 | 226 | 78 | 22 | 10 | 0.3 |
| 25 | 7.86 | 2832 | 565 | 148 | 47 | 347 | 3 | 0 | 201 | 496 | 549 | 18 | 1.4 |
| 26 | 7.98 | 7682 | 1400 | 253 | 187 | 1190 | 2 | 0 | 476 | 1418 | 1858 | 66 | 0.7 |
| 27 | 7.49 | 1031 | 330 | 42 | 55 | 59 | 0 | 0 | 372 | 57 | 62 | 66 | 0.5 |
| 28 | 7.7 | 1046 | 350 | 58 | 50 | 58 | 0 | 0 | 366 | 71 | 63 | 68 | 0.5 |
| 29 | 7.71 | 3233 | 1230 | 317 | 107 | 162 | 1 | 0 | 354 | 553 | 592 | 31 | 0.2 |
| 30 | 7.79 | 1343 | 325 | 88 | 26 | 119 | 2 | 0 | 391 | 106 | 126 | 48 | 0.5 |
| 31 | 7.67 | 2190 | 740 | 132 | 100 | 188 | 9 | 0 | 561 | 277 | 226 | 208 | 1.1 |
| 32 | 7.31 | 1542 | 500 | 96 | 63 | 113 | 1 | 0 | 464 | 181 | 105 | 76 | 0.7 |
| 33 | 7.67 | 2069 | 805 | 267 | 34 | 88 | 1 | 0 | 232 | 390 | 289 | 64 | 0.3 |
| 34 | 7.93 | 991 | 315 | 78 | 29 | 76 | 1 | 0 | 214 | 156 | 115 | 6 | 0.4 |
| 35 | 7.5 | 1400 | 585 | 134 | 61 | 49 | 0 | 0 | 330 | 149 | 117 | 74 | 0.5 |
| 36 | 7.46 | 4673 | 1400 | 357 | 124 | 465 | 2 | 0 | 293 | 709 | 1099 | 66 | 0.5 |
| 37 | 7.53 | 2783 | 945 | 212 | 101 | 124 | 1 | 0 | 464 | 355 | 302 | 174 | 0.3 |
| 38 | 7.56 | 3918 | 1440 | 457 | 73 | 170 | 14 | 0 | 391 | 496 | 872 | 11 | 0.2 |
| 39 | 7.62 | 1845 | 580 | 86 | 89 | 108 | 1 | 0 | 342 | 248 | 155 | 101 | 0.3 |
| 40 | 7.62 | 2365 | 875 | 98 | 153 | 141 | 2 | 0 | 421 | 255 | 474 | 115 | 0.4 |
| 41 | 7.67 | 1523 | 590 | 132 | 63 | 83 | 1 | 0 | 354 | 156 | 213 | 115 | 0.4 |
| 42 | 7.62 | 2567 | 730 | 124 | 102 | 259 | 2 | 0 | 427 | 454 | 293 | 17 | 0.4 |
| 43 | 7.33 | 1359 | 405 | 88 | 45 | 76 | 11 | 0 | 421 | 145 | 42 | 34 | 0.4 |
| 44 | 7.36 | 651 | 255 | 54 | 29 | 31 | 0 | 0 | 372 | 18 | 5 | 6 | 0.4 |
| 45 | 7.26 | 784 | 265 | 76 | 18 | 48 | 1 | 0 | 421 | 21 | 10 | 16 | 0.4 |
| 46 | 7.5 | 1115 | 390 | 82 | 45 | 50 | 1 | 0 | 397 | 103 | 11 | 68 | 0.4 |
| 47 | 7.69 | 653 | 180 | 30 | 26 | 58 | 2 | 0 | 183 | 64 | 85 | 7 | 0.2 |
| 48 | 7.72 | 997 | 295 | 80 | 23 | 67 | 2 | 0 | 250 | 92 | 88 | 64 | 0.3 |
| 49 | 7.65 | 1604 | 470 | 146 | 26 | 114 | 3 | 0 | 366 | 220 | 113 | 28 | 0.4 |

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------ mg/L ------------------------> | | | | | | | | | | |
| 50 | 7.77 | 1785 | 465 | 96 | 55 | 134 | 11 | 0 | 360 | 220 | 129 | 96 | 0.6 |
| 51 | 7.68 | 829 | 350 | 96 | 27 | 24 | 1 | 0 | 305 | 64 | 66 | 19 | 0.5 |
| 52 | 7.56 | 785 | 310 | 58 | 40 | 37 | 0 | 0 | 360 | 50 | 53 | 0 | 0.3 |
| 53 | 7.83 | 724 | 290 | 48 | 41 | 37 | 0 | 0 | 311 | 50 | 75 | 0 | 0.3 |
| 54 | 7.73 | 1168 | 385 | 70 | 51 | 88 | 0 | 0 | 464 | 99 | 75 | 17 | 0.5 |
| 55 | 7.73 | 1203 | 390 | 94 | 38 | 63 | 1 | 0 | 232 | 142 | 87 | 110 | 0.4 |
| 56 | 7.65 | 1267 | 295 | 34 | 51 | 89 | 61 | 0 | 476 | 92 | 19 | 34 | 0.4 |
| 57 | 7.52 | 2993 | 1180 | 337 | 83 | 119 | 33 | 0 | 293 | 482 | 457 | 45 | 0.4 |
| 58 | 7.76 | 751 | 235 | 54 | 24 | 60 | 1 | 0 | 305 | 50 | 55 | 8 | 0.4 |
| 59 | 7.77 | 1227 | 400 | 80 | 49 | 70 | 1 | 0 | 360 | 113 | 83 | 65 | 0.4 |
| 60 | 7.8 | 1232 | 415 | 96 | 43 | 63 | 1 | 0 | 354 | 121 | 76 | 71 | 0.4 |
| 61 | 7.82 | 935 | 210 | 36 | 29 | 115 | 1 | 0 | 330 | 71 | 92 | 7 | 0.5 |
| 62 | 7.75 | 1168 | 360 | 46 | 60 | 77 | 2 | 0 | 397 | 71 | 92 | 69 | 0.6 |
| 63 | 7.65 | 4271 | 1100 | 224 | 131 | 414 | 45 | 0 | 336 | 567 | 817 | 197 | 0.2 |
| 64 | 7.64 | 1033 | 355 | 66 | 46 | 53 | 1 | 0 | 262 | 43 | 212 | 25 | 0.2 |
| 65 | 7.83 | 5833 | 1530 | 285 | 199 | 653 | 3 | 0 | 378 | 1333 | 877 | 40 | 0.2 |
| 66 | 7.84 | 8056 | 2440 | 473 | 306 | 827 | 5 | 0 | 336 | 1801 | 1660 | 81 | 0.2 |
| 67 | 7.91 | 3710 | 770 | 128 | 109 | 441 | 2 | 0 | 586 | 610 | 504 | 46 | 1 |
| 68 | 7.14 | 3886 | 980 | 305 | 53 | 386 | 1 | 0 | 427 | 298 | 1091 | 22 | 1 |
| 69 | 7.56 | 6863 | 1510 | 176 | 260 | 831 | 48 | 0 | 458 | 383 | 2378 | 34 | 1 |
| 70 | 7.64 | 6975 | 2050 | 253 | 345 | 721 | 3 | 0 | 445 | 1631 | 874 | 135 | 0.7 |
| 71 | 7.58 | 1040 | 355 | 64 | 47 | 53 | 1 | 0 | 281 | 113 | 94 | 32 | 0.3 |
| 72 | 7.55 | 1282 | 415 | 110 | 34 | 104 | 2 | 0 | 427 | 156 | 90 | 53 | 0.4 |
| 73 | 7.9 | 822 | 280 | 46 | 40 | 65 | 2 | 0 | 238 | 71 | 107 | 24 | 0.3 |
| 74 | 7.78 | 1004 | 310 | 34 | 55 | 66 | 1 | 0 | 256 | 92 | 116 | 47 | 0.4 |
| 75 | 7.45 | 2751 | 640 | 122 | 81 | 266 | 3 | 0 | 397 | 454 | 300 | 70 | 0.4 |

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------ mg/L ------------------------------> | | | | | | | | | | |
| 76 | 7.6 | 2068 | 495 | 116 | 50 | 187 | 4 | 0 | 183 | 390 | 252 | 29 | 0.4 |
| 77 | 7.61 | 3038 | 820 | 192 | 83 | 236 | 2 | 0 | 360 | 397 | 358 | 104 | 0.3 |
| 78 | 7.47 | 3880 | 1520 | 325 | 173 | 215 | 1 | 0 | 305 | 284 | 1268 | 66 | 0.6 |
| 79 | 7.57 | 4003 | 1320 | 397 | 80 | 327 | 2 | 0 | 67 | 596 | 1049 | 0 | 0.2 |
| 80 | 7.5 | 2250 | 770 | 200 | 66 | 99 | 44 | 0 | 299 | 177 | 495 | 64 | 0.4 |
| 81 | 7.61 | 7115 | 2290 | 465 | 275 | 453 | 2 | 0 | 336 | 1404 | 1251 | 42 | 0.3 |
| 82 | 8.79 | 1301 | 290 | 64 | 32 | 133 | 1 | 12 | 31 | 191 | 285 | 2 | 5 |
| 83 | 7.43 | 3277 | 1360 | 345 | 122 | 127 | 1 | 0 | 275 | 298 | 901 | 81 | 0.6 |
| 84 | 7.63 | 980 | 115 | 18 | 17 | 145 | 1 | 0 | 61 | 220 | 92 | 1 | 4.9 |
| 85 | 7.25 | 1008 | 385 | 106 | 29 | 61 | 17 | 0 | 403 | 82 | 86 | 40 | 0.3 |
| 86 | 7.22 | 1193 | 405 | 102 | 36 | 77 | 14 | 0 | 391 | 113 | 78 | 73 | 0.4 |
| 87 | 7.76 | 809 | 175 | 38 | 19 | 93 | 1 | 0 | 305 | 50 | 46 | 45 | 0.4 |
| 88 | 7.53 | 562 | 220 | 42 | 28 | 34 | 0 | 0 | 293 | 21 | 29 | 27 | 0.7 |
| 89 | 7.62 | 2315 | 515 | 52 | 94 | 224 | 41 | 0 | 616 | 298 | 135 | 109 | 0.7 |
| 90 | 7.71 | 1268 | 310 | 44 | 49 | 120 | 5 | 0 | 317 | 170 | 71 | 70 | 0.7 |
| 91 | 8.22 | 1998 | 440 | 34 | 86 | 210 | 1 | 0 | 561 | 255 | 106 | 58 | 0.5 |
| 92 | 7.27 | 2532 | 690 | 54 | 135 | 170 | 41 | 0 | 555 | 411 | 118 | 43 | 0.2 |
| 93 | 7.77 | 880 | 275 | 60 | 30 | 62 | 1 | 0 | 366 | 50 | 56 | 28 | 0.5 |
| 94 | 7.73 | 817 | 265 | 46 | 36 | 46 | 18 | 0 | 366 | 35 | 38 | 27 | 0.5 |
| 95 | 7.82 | 742 | 155 | 42 | 12 | 86 | 1 | 0 | 299 | 35 | 52 | 19 | 0.7 |
| 96 | 8.08 | 937 | 110 | 18 | 16 | 152 | 1 | 0 | 159 | 170 | 80 | 35 | 1.2 |
| 97 | 7.41 | 3408 | 850 | 132 | 126 | 351 | 3 | 0 | 574 | 284 | 440 | 207 | 0.4 |
| 98 | 7.48 | 2661 | 550 | 160 | 36 | 326 | 3 | 0 | 116 | 560 | 360 | 4 | 1.4 |
| 99 | 7.93 | 1105 | 300 | 68 | 32 | 106 | 1 | 0 | 354 | 135 | 62 | 47 | 0.8 |
| 100 | 7.63 | 1706 | 410 | 116 | 29 | 170 | 3 | 0 | 317 | 191 | 276 | 44 | 0.7 |
| 101 | 7.88 | 6016 | 1240 | 281 | 131 | 787 | 1 | 0 | 488 | 128 | 2049 | 43 | 1.1 |

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------------ mg/L ------------------------------> | | | | | | | | | | |
| 102 | 7.44 | 1718 | 335 | 48 | 52 | 207 | 2 | 0 | 330 | 128 | 331 | 13 | 1 |
| 103 | 7.59 | 1784 | 425 | 108 | 38 | 174 | 2 | 0 | 342 | 277 | 149 | 72 | 0.3 |
| 104 | 7.4 | 2099 | 690 | 216 | 36 | 133 | 2 | 0 | 317 | 298 | 321 | 65 | 0.4 |
| 105 | 7.59 | 1445 | 520 | 116 | 56 | 109 | 7 | 0 | 397 | 156 | 109 | 84 | 0.2 |
| 106 | 7.67 | 779 | 295 | 60 | 35 | 34 | 1 | 0 | 287 | 57 | 72 | 12 | 0.3 |
| 107 | 7.47 | 1562 | 645 | 180 | 47 | 41 | 0 | 0 | 275 | 213 | 189 | 77 | 0.3 |
| 108 | 7.5 | 1489 | 570 | 186 | 26 | 57 | 1 | 0 | 281 | 206 | 189 | 48 | 0.2 |
| 109 | 7.78 | 892 | 320 | 42 | 52 | 45 | 1 | 0 | 360 | 60 | 45 | 26 | 0.7 |
| 110 | 7.71 | 1765 | 225 | 38 | 32 | 260 | 2 | 0 | 744 | 57 | 150 | 13 | 1.9 |
| 111 | 7.71 | 2815 | 545 | 84 | 81 | 325 | 2 | 0 | 336 | 553 | 199 | 69 | 0.5 |
| 112 | 7.42 | 803 | 305 | 54 | 41 | 31 | 0 | 0 | 348 | 57 | 10 | 22 | 0.5 |
| 113 | 7.71 | 1073 | 375 | 46 | 63 | 60 | 0 | 0 | 372 | 85 | 59 | 79 | 0.4 |
| 114 | 7.63 | 716 | 245 | 50 | 29 | 39 | 0 | 0 | 323 | 21 | 23 | 45 | 0.4 |
| 115 | 7.66 | 9922 | 3620 | 481 | 588 | 810 | 4 | 0 | 366 | 978 | 3108 | 99 | 0.5 |
| 116 | 7.66 | 3036 | 900 | 116 | 148 | 252 | 3 | 0 | 445 | 213 | 602 | 88 | 0.8 |
| 117 | 7.75 | 8710 | 2920 | 240 | 564 | 874 | 3 | 0 | 452 | 553 | 3047 | 96 | 0.6 |
| 118 | 7.28 | 5816 | 1700 | 401 | 170 | 558 | 2 | 0 | 262 | 1149 | 1010 | 52 | 1 |
| 119 | 7.73 | 7420 | 1840 | 361 | 228 | 855 | 3 | 0 | 458 | 1163 | 1518 | 86 | 1.4 |
| 120 | 7.36 | 2163 | 525 | 56 | 94 | 204 | 2 | 0 | 391 | 206 | 382 | 41 | 1.9 |
| 121 | 7.46 | 7846 | 2380 | 305 | 394 | 771 | 2 | 0 | 445 | 1248 | 1794 | 90 | 0.9 |
| 122 | 7.64 | 1021 | 310 | 70 | 33 | 80 | 3 | 0 | 372 | 50 | 92 | 58 | 0.2 |
| 123 | 7.77 | 2476 | 820 | 162 | 101 | 136 | 1 | 0 | 336 | 262 | 510 | 28 | 0.3 |
| 124 | 7.64 | 5696 | 2180 | 677 | 119 | 291 | 1 | 0 | 226 | 1347 | 852 | 70 | 0.3 |
| 125 | 7.79 | 2605 | 770 | 255 | 33 | 222 | 1 | 0 | 220 | 539 | 396 | 19 | 0.9 |
| 126 | 7.61 | 2587 | 945 | 283 | 58 | 160 | 4 | 0 | 330 | 284 | 680 | 34 | 0.7 |
| 127 | 8.03 | 859 | 170 | 36 | 19 | 98 | 2 | 0 | 366 | 60 | 14 | 25 | 0.5 |

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <- | | | | | mg/L | | | | -> | |
| 128 | 7.56 | 2155 | 550 | 78 | 86 | 187 | 62 | 0 | 452 | 298 | 226 | 116 | 0.7 |
| 129 | 7.36 | 1394 | 360 | 80 | 39 | 107 | 2 | 0 | 183 | 184 | 152 | 68 | 1.9 |
| 130 | 7.53 | 1284 | 225 | 62 | 17 | 134 | 2 | 0 | 128 | 206 | 137 | 22 | 2.6 |
| 131 | 7.63 | 2513 | 620 | 164 | 51 | 242 | 11 | 0 | 360 | 468 | 237 | 57 | 0.4 |
| 132 | 7.2 | 5216 | 1650 | 377 | 173 | 397 | 2 | 0 | 366 | 1134 | 756 | 84 | 0.3 |
| 133 | 7.53 | 2083 | 405 | 124 | 23 | 266 | 2 | 0 | 146 | 269 | 535 | 16 | 2.6 |
| 134 | 7.69 | 2710 | 630 | 132 | 73 | 252 | 9 | 0 | 519 | 220 | 530 | 20 | 0.6 |
| 135 | 7.95 | 539 | 60 | 12 | 7 | 99 | 1 | 0 | 207 | 43 | 39 | 10 | 1.3 |
| 136 | 7.95 | 623 | 65 | 12 | 9 | 108 | 1 | 0 | 207 | 28 | 91 | 1 | 0.4 |
| 137 | 7.77 | 1509 | 345 | 98 | 24 | 150 | 1 | 0 | 452 | 85 | 187 | 43 | 0.4 |
| 138 | 7.36 | 3422 | 960 | 216 | 102 | 325 | 3 | 0 | 360 | 312 | 898 | 9 | 0.5 |
| 139 | 7.65 | 1205 | 310 | 46 | 47 | 106 | 0 | 0 | 378 | 67 | 153 | 33 | 0.5 |
| 140 | 7.81 | 6200 | 1210 | 228 | 156 | 763 | 2 | 0 | 336 | 780 | 1633 | 8 | 1.1 |
| 141 | 7.89 | 5581 | 880 | 188 | 100 | 702 | 4 | 0 | 281 | 794 | 1216 | 30 | 2.1 |
| 142 | 7.76 | 7601 | 2860 | 489 | 399 | 632 | 5 | 0 | 342 | 1262 | 2099 | 37 | 0.2 |
| 143 | 7.42 | 3144 | 1030 | 96 | 192 | 239 | 3 | 0 | 464 | 440 | 425 | 209 | 0.5 |
| 144 | 7.73 | 1199 | 210 | 42 | 26 | 146 | 1 | 0 | 256 | 135 | 103 | 8 | 0.9 |
| 145 | 7.65 | 1623 | 495 | 88 | 67 | 112 | 1 | 0 | 494 | 163 | 145 | 26 | 0.5 |
| 146 | 7.36 | 1900 | 710 | 188 | 58 | 105 | 1 | 0 | 342 | 344 | 198 | 61 | 0.4 |
| 147 | 7.51 | 2927 | 780 | 297 | 10 | 223 | 1 | 0 | 287 | 369 | 527 | 103 | 0.2 |
| 148 | 7.58 | 2270 | 860 | 224 | 73 | 104 | 1 | 0 | 323 | 277 | 382 | 125 | 0.3 |
| 149 | 8.21 | 2358 | 150 | 22 | 23 | 441 | 1 | 0 | 1050 | 106 | 148 | 60 | 2.3 |
| 150 | 7.59 | 2429 | 790 | 267 | 30 | 141 | 1 | 0 | 244 | 397 | 361 | 82 | 0.6 |
| 151 | 7.4 | 2851 | 930 | 242 | 79 | 176 | 1 | 0 | 293 | 440 | 490 | 75 | 0.6 |
| 152 | 7.83 | 831 | 230 | 28 | 39 | 70 | 1 | 0 | 244 | 106 | 47 | 18 | 1 |
| 153 | 8.24 | 3574 | 560 | 72 | 92 | 546 | 1 | 0 | 763 | 496 | 514 | 49 | 2 |

| WELL NO | pH | EC | TH | $Ca^{2+}$ | $Mg^{2+}$ | $Na^{+}$ | $K^{+}$ | $CO_3^{2-}$ | $HCO_3^{-}$ | $Cl^{-}$ | $SO_4^{2-}$ | $NO_3^{-}$ | $F^{-}$ |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | µS/cm | <------------------------ | | | | | mg/L | | | | ------------------------> | |
| 154 | 7.56 | 2510 | 975 | 178 | 129 | 142 | 2 | 0 | 348 | 319 | 537 | 61 | 0.5 |
| 155 | 7.75 | 2134 | 510 | 120 | 51 | 225 | 0 | 0 | 403 | 284 | 306 | 61 | 0.6 |
| 156 | 7.81 | 2140 | 445 | 138 | 24 | 275 | 2 | 0 | 201 | 206 | 632 | 20 | 0.6 |
| 157 | 7.72 | 560 | 225 | 42 | 29 | 21 | 0 | 0 | 262 | 14 | 52 | 3 | 0.4 |
| 158 | 7.72 | 2043 | 395 | 110 | 29 | 250 | 2 | 0 | 195 | 291 | 365 | 36 | 1.4 |
| 159 | 7.55 | 3767 | 1040 | 309 | 66 | 288 | 2 | 0 | 287 | 666 | 569 | 64 | 0.4 |
| 160 | 7.28 | 1116 | 385 | 76 | 47 | 71 | 12 | 0 | 378 | 106 | 65 | 75 | 0.4 |
| 161 | 7.74 | 2192 | 405 | 74 | 53 | 243 | 1 | 0 | 214 | 284 | 390 | 52 | 0.7 |
| 162 | 7.69 | 1814 | 470 | 118 | 43 | 143 | 1 | 0 | 445 | 234 | 113 | 48 | 1.3 |
| 163 | 7.47 | 1303 | 440 | 68 | 66 | 67 | 0 | 0 | 372 | 113 | 115 | 72 | 0.2 |
| 164 | 7.78 | 673 | 150 | 34 | 16 | 78 | 0 | 0 | 275 | 43 | 48 | 12 | 0.3 |
| 165 | 7.34 | 887 | 230 | 56 | 22 | 72 | 1 | 0 | 195 | 121 | 77 | 8 | 1 |
| 166 | 7.64 | 1696 | 415 | 104 | 38 | 144 | 40 | 0 | 445 | 177 | 147 | 66 | 0.6 |

## Annexure-IX

# Heavy Metal Chemistry of Ground Water Samples, Pre-Monsoon Season, 2023.

| S. No. | Location | Source | Lat | Long | B | Al | Cr | Mn | Fe | Ni | Cu | Zn | As | Se | Sr | Mo | Ag | Cd | Ba |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Dafalpur | BW | 17.0104 | 75.1065 | 0.035 | 0.009 | 0 | 0.001 | 0.009 | 0.001 | 0.003 | 0.004 | 0 | 0.001 | 0.105 | 0 | 0 | 0 | 0.005 |
| 2 | Khalati | DW | 17.0156 | 75.1317 | 0.027 | 0.055 | 0 | 0.007 | 0.038 | 0.001 | 0.005 | 0.009 | 0 | 0 | 0.143 | 0 | 0 | 0 | 0.003 |
| 3 | Rampur | BW | 17.0419 | 75.1792 | 0.058 | 0.008 | 0 | 0 | 0.002 | 0.001 | 0.003 | 0.003 | 0 | 0.018 | 0.175 | 0 | 0 | 0 | 0.014 |
| 4 | Jath | HP | 17.0464 | 75.1974 | 0.087 | 0.001 | 0 | 0.004 | 0 | 0.001 | 0.001 | 0.192 | 0 | 0.002 | 0.119 | 0 | 0 | 0 | 0.001 |
| 5 | Jath | BW | 17.0457 | 75.2174 | 0.192 | 0.001 | 0 | 0 | 0.001 | 0.002 | 0.003 | 0.037 | 0.008 | 0 | 0.281 | 0.013 | 0 | 0 | 0.007 |
| 6 | Yeldari | HP | 16.9931 | 75.1880 | 0.182 | 0 | 0 | 0.01 | 0 | 0.001 | 0.001 | 0.227 | 0 | 0 | 0.953 | 0.001 | 0 | 0 | 0 |
| 7 | Bilur | BW | 16.9449 | 75.1832 | 0.368 | 0.001 | 0 | 0 | 0 | 0.001 | 0.002 | 0.019 | 0 | 0.003 | 0.394 | 0.006 | 0 | 0 | 0.011 |
| 8 | Basargi | HP | 16.8997 | 75.1847 | 0.097 | 0 | 0 | 0 | 0.001 | 0.001 | 0.003 | 0.102 | 0 | 0.001 | 0.393 | 0.001 | 0 | 0 | 0.004 |
| 9 | Sindur | BW | 16.8735 | 75.2126 | 0.221 | 0.001 | 0 | 0 | 0.001 | 0.001 | 0.007 | 0.009 | 0 | 0.004 | 0.226 | 0.002 | 0 | 0 | 0.006 |
| 10 | Gugwad | HP | 16.8839 | 75.1573 | 0.057 | 0 | 0 | 0 | 0 | 0 | 0.001 | 0.031 | 0 | BDL | 0.022 | 0 | 0 | 0 | 0.001 |
| 11 | Vajrawad | HP | 16.9086 | 75.1377 | 0.065 | 0 | 0 | 0.006 | 0 | 0.001 | 0.001 | 0.181 | 0 | 0.002 | 0.209 | 0 | 0 | 0 | 0.001 |
| 12 | Ekundi | HP | 16.9284 | 75.0987 | 0.073 | 0 | 0 | 0.009 | 0 | 0 | 0.001 | 0.12 | 0 | BDL | 0.244 | 0 | 0 | 0 | 0 |
| 13 | Jigyral | BW | 16.9579 | 75.1080 | 0.054 | 0.001 | 0 | 0.001 | 0 | 0 | 0.001 | 0.012 | 0 | 0.001 | 0.043 | 0 | 0 | 0 | 0.001 |
| 14 | Dafalapur | HP | 17.0020 | 75.0738 | 0.231 | 0 | 0 | 0 | 0 | 0.001 | 0.003 | 0.007 | 0 | 0.001 | 0.738 | 0.006 | 0 | 0 | 0.002 |
| 15 | Belunki | HP | 17.0258 | 75.0746 | 0.093 | 0 | 0 | 0.013 | 0 | 0.001 | 0.002 | 0.609 | 0 | 0 | 0.07 | 0 | 0 | 0 | 0.001 |
| 16 | Baj | HP | 17.0480 | 75.0643 | 0.1 | 0.001 | 0 | 0.001 | 0.002 | 0 | 0.001 | 0.032 | 0 | BDL | 0.077 | 0.001 | 0 | 0 | 0.001 |
| 17 | Kanthi | HP | 17.0598 | 75.1563 | 0.054 | 0 | 0 | 0.005 | 0 | 0.001 | 0.006 | 0.044 | 0 | BDL | 0.115 | 0 | 0 | 0 | 0.001 |

| S. No. | Location | Source | Lat | Long | B | Al | Cr | Mn | Fe | Ni | Cu | Zn | As | Se | Sr | Mo | Ag | Cd | Ba |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 18 | Devnal | HP | 17.0024 | 75.2439 | 0.173 | 0 | 0 | 0.04 | 0 | 0.001 | 0.001 | 0.372 | 0 | 0.001 | 0.61 | 0 | 0 | 0 | 0.001 |
| 19 | Mendhegiri | BW | 16.9967 | 75.2423 | 0.21 | 0 | 0.001 | 0.001 | 0.004 | 0 | 0 | 0.012 | 0 | 0 | 0.127 | 0 | 0 | 0 | 0.003 |
| 20 | Umarani | BW | 16.9032 | 75.2527 | 0.393 | 0.001 | 0 | 0 | 0.001 | 0 | 0.002 | 0.008 | 0 | 0.001 | 0.373 | 0.01 | 0 | 0 | 0.008 |
| 21 | Ravalgundwadi | BW | 16.9778 | 75.2875 | 0.06 | 0.001 | 0.002 | 0 | 0.009 | 0.001 | 0.001 | 0.014 | 0 | BDL | 0.016 | 0.001 | 0 | 0 | 0.001 |
| 22 | Untwadi | HP | 16.9862 | 75.2711 | 0.472 | 0.001 | 0.001 | 0 | 0 | BDL | 0 | 0.007 | 0 | 0 | 0.069 | 0.001 | 0 | 0 | 0.001 |
| 23 | Muchandi | HP | 16.9909 | 75.3149 | 0.305 | 0 | 0 | 0.005 | 0 | 0 | 0 | 0.079 | 0 | 0.001 | 0.142 | 0.001 | 0 | 0 | 0 |
| 24 | Muchandi | HP | 16.9827 | 75.3347 | 0.344 | 0 | 0 | 0 | 0 | BDL | 0 | 0.02 | 0 | BDL | 0.543 | 0.001 | 0 | 0 | 0.001 |
| 25 | Darikonur | HP | 17.0143 | 75.3687 | 0.211 | 0.003 | 0 | 0 | 0.003 | BDL | 0 | 0.002 | 0 | BDL | 0.481 | 0.001 | 0 | 0 | 0.004 |
| 26 | Sordi | HP | 17.0718 | 75.3849 | 0.033 | 0.001 | 0.001 | 0 | 0.005 | BDL | 0 | 0.01 | 0 | BDL | 0.018 | 0 | 0 | 0 | 0 |
| 27 | Guddapur | HP | 17.0875 | 75.4056 | 0.038 | 0 | 0 | 0 | 0 | 0 | 0.001 | 0.082 | 0 | BDL | 0.04 | 0.001 | 0 | 0 | 0.001 |
| 28 | Asangi Jat | HP | 17.0812 | 75.4531 | 0.044 | 0 | 0 | 0 | 0 | 0.001 | 0.002 | 0.192 | 0 | BDL | 0.048 | 0.001 | 0 | 0 | 0.001 |
| 29 | Sankh | HP | 17.0751 | 75.4937 | 0.062 | 0.001 | 0.001 | 0.022 | 0.004 | 0 | 0.002 | 0.428 | 0 | BDL | 0.012 | 0.004 | 0 | 0 | 0 |
| 30 | Daribadachi | HP | 17.0437 | 75.4066 | 0.122 | 0 | 0 | 0.172 | 0 | 0 | 0.005 | 1.814 | 0 | BDL | 0.029 | 0.004 | 0 | 0 | 0.004 |
| 31 | Daribadachi | HP | 17.0330 | 75.4251 | 0.247 | 0 | 0 | 0.196 | 0 | 0.002 | 0.001 | 1.406 | 0 | 0 | 0.574 | 0.001 | 0 | 0 | 0.001 |
| 32 | Pandharewadi | BW | 17.0113 | 75.4675 | 0.219 | 0 | 0 | 0.013 | 0 | 0 | 0.001 | 0.142 | 0 | BDL | 0.644 | 0.001 | 0 | 0 | 0.001 |
| 33 | Asangi Turk | HP | 17.0064 | 75.4757 | 0.061 | 0 | 0 | 0.001 | 0.001 | 0 | 0.002 | 0.025 | 0 | 0 | 0.076 | 0 | 0 | 0 | 0.004 |
| 34 | Motewadi | HP | 16.9957 | 75.5269 | 0.156 | 0.001 | 0 | 0 | 0 | 0 | 0.001 | 0.01 | 0 | 0 | 0.029 | 0.001 | 0 | 0 | 0.005 |
| 35 | Pandozari | BW | 17.0394 | 75.5217 | 0.048 | 0 | 0 | 0.182 | 0.001 | 0.001 | 0 | 0.992 | 0 | BDL | 0.13 | 0.002 | BDL | 0 | 0.001 |
| 36 | Tikondi | BW | 17.0299 | 75.5684 | 0.16 | 0.001 | 0 | 0.007 | 0 | BDL | 0.001 | 0.059 | 0 | 0.001 | 0.134 | 0.001 | 0 | 0 | 0.001 |
| 37 | Konbagi | HP | 16.9804 | 75.6150 | 0.091 | 0.001 | 0 | 0 | 0 | BDL | 0.001 | 0.004 | 0 | 0 | 0.118 | 0 | 0 | 0 | 0.002 |

| S. No. | Location | Source | Lat | Long | B | Al | Cr | Mn | Fe | Ni | Cu | Zn | As | Se | Sr | Mo | Ag | Cd | Ba |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 38 | Gulgunjnal | BW | 17.0269 | 75.6600 | 0.016 | 0 | 0.003 | 0 | 0.011 | 0 | 0 | 0.01 | 0 | BDL | 0 | 0 | 0 | 0 | 0 |
| 39 | Jalyal BK | HP | 17.0601 | 75.6021 | 0.018 | 0.006 | 0.008 | 0.006 | 0.012 | 0.006 | 0.006 | 0.011 | 0.005 | 0.004 | 0.006 | 0.005 | 0.004 | 0.005 | 0.005 |
| 40 | Morbagi | HP | 17.0897 | 75.6135 | 0.014 | BDL | BDL | 0.024 | BDL | BDL | 0.001 | 0.126 | 0 | 0 | 0.551 | 0 | BDL | 0 | 0 |
| 41 | Kolgiri | HP | 17.1064 | 75.3265 | 0.054 | BDL | BDL | 0.005 | BDL | BDL | 0 | 0.302 | 0 | 0 | 0.673 | 0 | BDL | 0 | 0.002 |
| 42 | Karajanagi | HP | 17.1113 | 75.3027 | 0.02 | 0.004 | 0.006 | 0.003 | 0.014 | 0.003 | 0.003 | 0.013 | 0.003 | 0.002 | 0.003 | 0.004 | 0.003 | 0.003 | 0.003 |
| 43 | Nigadi | HP | 17.1178 | 75.2724 | 0.018 | 0.001 | 0.002 | 0 | 0.007 | 0 | 0 | 0.011 | 0 | 0 | 0.011 | 0 | 0 | 0 | 0 |
| 44 | Sanamadi | BW | 17.1402 | 75.3438 | 0.024 | 0 | 0.001 | 0 | 0.002 | BDL | 0 | 0.012 | 0 | BDL | 0.024 | 0 | 0 | 0 | 0 |
| 45 | Tonewadi | HP | 17.1807 | 75.3477 | 0.375 | 0 | 0.001 | 0.002 | 0.005 | 0.001 | 0.004 | 0.055 | 0 | 0.001 | 0.83 | 0.017 | 0 | 0 | 0.005 |
| 46 | Yelvi | BW | 17.1968 | 75.3105 | 0.089 | 0 | 0 | 0.042 | 0 | 0.001 | 0.001 | 0.262 | 0 | BDL | 0.016 | 0.003 | 0 | 0 | 0 |
| 47 | Boblad | HP | 17.2215 | 75.4344 | 0.06 | 0.001 | 0.002 | 0 | 0.006 | 0 | 0.001 | 0.024 | 0 | 0 | 0.042 | 0 | 0 | 0 | 0 |
| 48 | Nigadi | HP | 17.2355 | 75.5221 | 0.047 | 0.001 | 0.004 | 0.001 | 0.007 | 0.001 | 0.001 | 0.127 | 0 | 0 | 0.128 | 0 | 0 | 0 | 0.001 |
| 49 | Balgaon | BW | 17.1950 | 75.6018 | 0.058 | 0 | 0.002 | 0.006 | 0.007 | 0 | 0.001 | 0.507 | 0 | 0 | 0.146 | 0 | 0 | 0 | 0.002 |
| 50 | Boragi | BW | 17.1371 | 75.5887 | 0.422 | 0.001 | 0.002 | 0 | 0.008 | 0 | 0.001 | 0.014 | 0 | 0.001 | 0.622 | 0.001 | 0 | 0 | 0.017 |
| 51 | Bhiwargi | BW | 17.0881 | 75.5623 | 0.185 | 0 | 0 | 0 | 0 | BDL | 0 | 0 | 0 | 0.001 | 0.392 | 0.001 | 0 | 0 | 0.001 |
| 52 | Revnal | BW | 17.1160 | 75.1909 | 0.104 | 0.001 | 0.002 | 0.001 | 0.006 | 0 | 0.001 | 0.009 | 0 | BDL | 0.201 | 0.001 | 0 | 0 | 0.003 |
| 53 | Bewanal | BW | 17.1355 | 75.1974 | 0.126 | 0.007 | 0 | 0.021 | 0.007 | 0 | 0.001 | 0.006 | 0 | BDL | 0.452 | 0 | 0 | 0 | 0.025 |
| 54 | Dahewadi | DW | 17.1246 | 75.0712 | 0.029 | 0.006 | 0 | 0 | 0.006 | BDL | 0.003 | 0.009 | 0 | 0.001 | 0.029 | 0 | 0 | 0 | 0.002 |
| 55 | Dahewadi | SW | 17.1246 | 75.0712 | 0.054 | 0.001 | 0 | 0 | 0.001 | BDL | 0.001 | 0 | 0 | BDL | 0.089 | 0 | 0 | 0 | 0.003 |
| 56 | Kumbari | HP | 17.1109 | 75.1177 | 0.06 | 0.001 | 0 | 0 | 0.001 | BDL | 0.001 | 0.001 | 0 | 0 | 0.112 | 0 | 0 | 0 | 0.003 |
| 57 | Konsari | SW | 17.1426 | 75.1316 | 0.07 | 0 | 0 | 0 | 0.001 | 0 | 0.001 | 0.027 | 0 | BDL | 0.363 | 0.001 | 0 | 0 | 0.001 |

| S. No. | Location | Source | Lat | Long | B | Al | Cr | Mn | Fe | Ni | Cu | Zn | As | Se | Sr | Mo | Ag | Cd | Ba |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 58 | Konsari | HP | 17.1519 | 75.1344 | 0.023 | 0.001 | 0.008 | 0 | 0.026 | 0.002 | 0 | 0.03 | 0 | BDL | 0.001 | 0 | 0 | 0 | 0.001 |
| 59 | Singanhali | HP | 17.2275 | 75.1552 | 0.041 | 0.001 | 0 | 0.01 | 0 | BDL | 0.001 | 0.049 | 0 | BDL | 0.124 | 0.001 | 0 | 0 | 0.001 |
| 60 | Shegaon | BW | 17.1635 | 75.1794 | 0.152 | 0 | 0 | 0.216 | 0 | 0.001 | 0.001 | 0.526 | 0 | 0 | 0.41 | 0.002 | 0 | 0 | 0.001 |
| 61 | Jath | BW | 17.0587 | 75.2177 | 0.661 | 0 | 0 | 0.001 | 0 | 0 | 0.002 | 0.012 | 0 | 0.001 | 1.051 | 0.002 | 0 | 0 | 0.003 |
| 62 | Walsang | BW | 17.0559 | 75.2936 | 0.084 | 0.001 | 0 | 0 | 0.001 | BDL | 0.001 | 0.013 | 0 | BDL | 0.506 | 0 | 0 | 0 | 0.004 |
| 63 | Walsang | HP | 17.0586 | 75.3143 | 0.728 | 0 | 0.003 | 0 | 0.001 | BDL | 0 | 0.005 | 0 | 0.003 | 0.661 | 0 | 0 | 0 | 0.004 |
| 64 | Kolgiri | BW | 17.0930 | 75.3398 | 0.265 | 0 | 0 | 0.001 | 0 | BDL | 0.001 | 0.025 | 0 | 0.001 | 0.559 | 0.002 | 0 | 0 | 0.003 |
| 65 | madgyal | HP | 17.1433 | 75.4256 | 0.165 | 0.007 | 0 | 0.006 | 0.005 | BDL | 0.038 | 0.049 | 0 | 0 | 0.61 | 0.004 | 0 | 0 | 0.004 |
| 66 | Soriyal | BW | 17.1761 | 75.4551 | 0.017 | BDL | 0 | BDL | BDL | BDL | 0 | 0.026 | 0 | 0.001 | 0.107 | 0 | BDL | BDL | BDL |
| 67 | Utagi | HP | 17.1918 | 75.4972 | 0.053 | 0.001 | 0.002 | 0.056 | 0.028 | 0 | 0.002 | 0.277 | 0 | 0 | 0.046 | 0.001 | 0 | 0 | 0.002 |

# Annuxure -x Suggestions of NLEC in respect of CR, Nagpur

## Minutes of the 12th meeting of the National Level Expert Committee (NLEC) 4th & 5th April 2024 at CGWB, CHQ, Faridabad

12th meeting of the National Level Expert Committee for review and finalization of aquifer maps and management plans was held on 4th and 5th April 2024 at CGWB Faridabad under the Chairmanship of the Chairman, CGWB. Findings of 19 representative studies were presented before the NLEC. Presentations were made by Regional Directors/HOO in respect of area covered in AAP 2023-24. Priority area wise numbers of presentations made in the meeting are summarized below.

***Region: CR, Nagpur Study:*** NAQUIM Studies in Inkatol block, Nagpur district, Maharashatra Comments of NLEC:

- The management plan is to be reviewed/ proper justification should be provided in respect of the proposed interventions.
- It was advised that management plans should be implementable.
- Comparison of rainfall with water level fluctuation may be incorporated.
- It was suggested that while giving any correlation plot/equation, $R^2$ value may be given
- Artificial recharge through already existing structures may be calculated. Also the efficacy of AR structures may be evaluated.
- It was suggested to use various parameters calculated from NAQUIM studies instead of normative values used for estimation.

# **Annexure XI:** Location of VES Point

| VES No. | District | Village | Taluka | Location | Latitude | Longitude | RL (m) | Layers | Resistivity (Ohm m) | Thickness (m) | Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Sangli | Jath | Jath | Ground | 17°01'54"N | 75°12'45"E | 701 | I | 140 | 0.647 | 0.647 |
| | | | | | | | | II | 34.3 | 12.8 | 13.4 |
| | | | | | | | | III | 12.5 | 27.3 | 40.8 |
| | | | | | | | | IV | 13898 | | |
| 2 | Sangli | Billur | Jath | Agriculture land | 16°56'11" N | 75°11'12"E | 680 | I | 25.45 | 6.781 | 6.781 |
| | | | | | | | | II | 14.54 | 7.793 | 14.57 |
| | | | | | | | | III | 1392 | | |
| 3 | Sangli | Rampur | Jath | Open field | 17°02'37"N | 75°11'18"E | | I | 525 | 0.496 | 0.496 |
| | | | | | | | | II | 35.5 | 18.5 | 19 |
| | | | | | | | | III | 175 | 22.5 | 41.4 |
| | | | | | | | | IV | 16.5 | 48.1 | 89.6 |
| | | | | | | | | V | 1492 | | |
| 4 | Sangli | Washan | Jath | Road side | 17°01'44" N | 75°09'36"E | | I | 11 | 4.54 | 4.54 |
| | | | | | | | | II | 684 | 7.17 | 11.7 |
| | | | | | | | | III | 10 | 41.2 | 52.9 |
| | | | | | | | | IV | 3325 | | |
| 5 | Sangli | Gaikwad Wasti | Jath | Road side | 17°00'19"N | 75°05'38"E | | I | 45.95 | 4.028 | 4.028 |
| | | | | | | | | II | 154 | 4.958 | 8.986 |
| | | | | | | | | III | 57.48 | 36.45 | 45.44 |
| | | | | | | | | IV | 80.5 | | |
| 6 | Sangli | Ekundi | Jath | Open field | 16°56'39"N | 75°06'11"E | | I | 52 | 1.09 | 1.09 |
| | | | | | | | | II | 130 | 2.35 | 3.44 |
| | | | | | | | | III | 31 | 11 | 14.5 |
| | | | | | | | | IV | 12.4 | 15 | 29.4 |
| | | | | | | | | V | 119 | | |
| 7 | Sangli | Amrutwadi | Jath | Agriculture land | 17°03'16"N | 75°16'12"E | | I | 2.68 | 7.09 | 7.09 |
| | | | | | | | | II | 8.14 | 28.3 | 35.4 |
| | | | | | | | | III | 110 | | |
| 8 | Sangli | Koigiri | Jath | Agriculture land | 17°05'29"N | 75°20'19"E | | I | 4 | 5.83 | 5.83 |
| | | | | | | | | II | 56.5 | 51.8 | 57.6 |
| | | | | | | | | III | 197 | | |
| 9 | Sangli | Sanamadi | Jath | Open field | 17°10'09"N | 75°20'37"E | | I | 127.6 | 6.721 | 6.721 |
| | | | | | | | | II | 146.3 | 15.17 | 21.9 |
| | | | | | | | | III | 59.83 | 177.4 | 199.3 |
| | | | | | | | | IV | 299.5 | | |
| 10 | Sangli | Khairao | Jath | Agriculture land | 17°13'39"N | 75°21'13"E | | I | 81.88 | 1.8 | 1.8 |
| | | | | | | | | II | 97.87 | 6.205 | 8.005 |

| VES No. | District | Village | Taluka | Location | Latitude | Longitude | RL (m) | Layers | Resistivity (Ohm m) | Thickness (m) | Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | III | 27.36 | 27.58 | 35.58 |
| | | | | | | | | IV | 211.9 | 39.43 | 75.01 |
| | | | | | | | | V | 17.62 | | |
| 11 | Sangli | Amrutwadi | Jath | Agriculture land | 17°03'16"N | 75°16'12"E | | I | 99.2 | 1.16 | 1.16 |
| | | | | | | | | II | 250 | 1.78 | 2.94 |
| | | | | | | | | III | 76.4 | 3.62 | 6.56 |
| | | | | | | | | IV | 507 | 10.9 | 17.5 |
| | | | | | | | | V | 20.1 | 9.19 | 26.6 |
| 12 | Sangli | Birnal | Jath | Open field | 17°05'45"N | 75°08'40"E | | I | 57.4 | 1.31 | 1.31 |
| | | | | | | | | II | 787 | 0.5 | 1.81 |
| | | | | | | | | III | 123 | 64.4 | 66.2 |
| | | | | | | | | IV | 65.3 | | |
| 13 | Sangli | Khumbari | Jath | Open field | 17°06'09"N | 75°06'15"E | | I | 123 | 1.8 | 1.8 |
| | | | | | | | | II | 605 | 2.14 | 3.94 |
| | | | | | | | | III | 15.8 | 14.9 | 18.8 |
| | | | | | | | | IV | 97.7 | | |
| 14 | Sangli | Hivare | Jath | Open field | 17°05'59"N | 75°04'50"E | | I | 39.7 | 1.8 | 1.8 |
| | | | | | | | | II | 69.4 | 7.31 | 9.11 |
| | | | | | | | | III | 86.1 | 35.8 | 44.9 |
| | | | | | | | | IV | 54.6 | | |
| 15 | Sangli | Dhavadwadi | Jath | Open field | 17°07'16"N | 75°05'05"E | | I | 113 | 2.55 | 2.55 |
| | | | | | | | | II | 68.9 | 14.3 | 16.8 |
| | | | | | | | | III | 23.1 | 23.1 | 39.9 |
| | | | | | | | | IV | 233 | 48.5 | 88.4 |
| | | | | | | | | V | 3.37 | | |
| 16 | Sangli | Chorochi | Jath | Open field | 17°08'27"N | 75°00'43"E | | I | 116 | 2.31 | 2.31 |
| | | | | | | | | II | 67.9 | 11.4 | 13.8 |
| | | | | | | | | III | 17.3 | 8.51 | 22.3 |
| | | | | | | | | IV | 66 | | |
| 18 | Sangli | Shedyal | Jath | Agriculture land | 17°01'52"N | 75°18'42"E | | I | 3.45 | 1.51 | 1.51 |
| | | | | | | | | II | 13.1 | 2.15 | 3.66 |
| | | | | | | | | III | 1.15 | 4.85 | 8.51 |
| | | | | | | | | IV | 25.8 | | |
| 19 | Sangli | Soradi | Jath | Open field | 17°04'00"N | 75°23'54"E | | I | 109 | 4.02 | 4.02 |
| | | | | | | | | II | 511 | 4.96 | 8.98 |
| | | | | | | | | III | 65.6 | 35.8 | 44.8 |
| | | | | | | | | IV | 40.3 | | |
| 20 | Sangli | Asangi Jat | Jath | Open field | 17°04'42"N | 75°25'30"E | | I | 112 | 2.93 | 2.93 |
| | | | | | | | | II | 484 | 3.49 | 6.42 |

| VES No. | District | Village | Taluka | Location | Latitude | Longitude | RL (m) | Layers | Resistivity (Ohm m) | Thickness (m) | Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | III | 80 | 39.9 | 46.4 |
| | | | | | | | | IV | 17.9 | 34.4 | 80.7 |
| | | | | | | | | V | 4331 | | |
| 21 | Sangli | Lakdewadi | Jath | Open field | 17°09'06"N | 75°25'16"E | | I | 111 | 5.93 | 5.93 |
| | | | | | | | | II | 199 | 8.9 | 14.8 |
| | | | | | | | | III | 119 | | |
| | | | | | | | | III | 22.9 | 26.1 | 47.6 |
| | | | | | | | | IV | 21626 | | |
| 23 | Sangli | Sonyal | Jath | Agriculture land | 17°11'15"N | 75°26'47"E | | I | 61.2 | 3.92 | 3.92 |
| | | | | | | | | II | 32.6 | 18 | 21.9 |
| | | | | | | | | III | 189 | | |
| 24 | Sangli | Ankalagi | Jath | Open field | 17°08'07"N | 75°29'33"E | | I | 83.08 | 2.283 | 2.283 |
| | | | | | | | | II | 30.42 | 41.8 | 44.08 |
| | | | | | | | | III | 416.8 | 48.62 | 92.7 |
| | | | | | | | | IV | 9.249 | | |
| 25 | Sangli | Sankh | Jath | Agriculture land | 17°04'39"N | 75°29'53"E | | I | 11.6 | 1.31 | 1.31 |
| | | | | | | | | II | 2.17 | 1.35 | 2.66 |
| | | | | | | | | III | 10.7 | 12.4 | 15.1 |
| | | | | | | | | IV | 1210 | 19 | 34.1 |
| | | | | | | | | V | 3.22 | | |
| 26 | Sangli | Gondhalewadi | Jath | Open field | 17°04'37"N | 75°27'41"E | | I | 107 | 4.18 | 4.18 |
| | | | | | | | | II | 26.9 | 2.82 | 7 |
| | | | | | | | | III | 99.8 | | |
| 27 | Sangli | Pandozari | Jath | Agriculture land | 17°01'39"N | 75°31'38"E | | I | 104 | 5.38 | 5.38 |
| | | | | | | | | II | 40.1 | 3.57 | 8.95 |
| | | | | | | | | III | 204 | 4.14 | 13.1 |
| | | | | | | | | IV | 82.1 | 187 | 200 |
| | | | | | | | | V | 18.6 | | |
| 28 | Sangli | Kanganari | Jath | Agriculture land | 16°59'52"N | 75°31'59"E | | I | 122 | 1.8 | 1.8 |
| | | | | | | | | II | 172 | 6.22 | 8.02 |
| | | | | | | | | III | 69.4 | 8.87 | 16.9 |
| | | | | | | | | IV | 384 | 18.7 | 35.6 |
| | | | | | | | | V | 21.9 | 39.4 | 75 |
| 29 | Sangli | Lamantanda | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 18.4 | 1.29 | 1.29 |
| | | | | | | | | II | 676 | 0.472 | 1.76 |
| | | | | | | | | III | 91.3 | 29 | 30.7 |
| | | | | | | | | IV | 202 | 44.2 | 74.9 |
| | | | | | | | | V | 3.6 | | |
| 30 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 114 | 2.34 | 2.34 |

| VES No. | District | Village | Taluka | Location | Latitude | Longitude | RL (m) | Layers | Resistivity (Ohm m) | Thickness (m) | Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | II | 66.2 | 2.65 | 4.99 |
| | | | | | | | | III | 1068 | 15.6 | 20.6 |
| | | | | | | | | IV | 26 | 44.4 | 65 |
| | | | | | | | | V | 4822 | | |
| 31 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 127 | 1.14 | 1.14 |
| | | | | | | | | II | 322 | 15.2 | 16.3 |
| | | | | | | | | III | 19.6 | 24.9 | 41.2 |
| | | | | | | | | IV | 322 | 34.4 | 75.6 |
| | | | | | | | | V | 1.76 | | |
| 32 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 111 | 2.07 | 2.07 |
| | | | | | | | | II | 23.3 | 7.26 | 9.33 |
| | | | | | | | | III | 12.4 | 8.83 | 18.2 |
| | | | | | | | | IV | 80.8 | | |
| 33 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 21.36 | 1.8 | 1.8 |
| | | | | | | | | II | 48.56 | 2.525 | 4.325 |
| | | | | | | | | III | 4.838 | 6.067 | 10.39 |
| | | | | | | | | IV | 10.56 | 14.58 | 24.97 |
| | | | | | | | | V | 202.8 | 35.03 | 60 |
| 34 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 124 | 2.4 | 2.4 |
| | | | | | | | | II | 101 | 21.6 | 24 |
| | | | | | | | | III | 52 | | |
| 35 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 65.6 | 0.394 | 0.394 |
| | | | | | | | | II | 192 | 16.6 | 17 |
| | | | | | | | | III | 31.5 | 105 | 122 |
| | | | | | | | | IV | 1399 | | |
| 36 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 2.5 | 5.71 | 5.71 |
| | | | | | | | | II | 1.21 | 7.95 | 13.7 |
| | | | | | | | | III | 4478 | | |
| 37 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 322 | 1.29 | 1.29 |
| | | | | | | | | II | 55.1 | 1.63 | 2.92 |
| | | | | | | | | III | 251 | 4.61 | 7.53 |
| | | | | | | | | IV | 35.4 | 10.8 | 18.3 |
| | | | | | | | | V | 249 | 15.6 | 33.9 |
| 38 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 174 | 1.04 | 1.04 |
| | | | | | | | | II | 965 | 0.828 | 1.86 |
| | | | | | | | | III | 209 | 28.7 | 30.6 |
| | | | | | | | | IV | 112 | 133 | 163 |
| | | | | | | | | V | 3.43 | | |
| 39 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 117.1 | 2.205 | 2.205 |

| VES No. | District | Village | Taluka | Location | Latitude | Longitude | RL (m) | Layers | Resistivity (Ohm m) | Thickness (m) | Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | II | 28.3 | 6.725 | 8.93 |
| | | | | | | | | III | 2.301 | 9.731 | 18.66 |
| | | | | | | | | IV | 12.93 | 87.17 | 105.8 |
| | | | | | | | | V | 1107 | | |
| 40 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 4.554 | 1.8 | 1.8 |
| | | | | | | | | II | 2.315 | 2.22 | 4.02 |
| | | | | | | | | III | 13.84 | 4.958 | 8.978 |
| | | | | | | | | IV | 2.113 | 11.07 | 20.05 |
| | | | | | | | | V | 1073 | | |
| 41 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 37.7 | 0.768 | 0.768 |
| | | | | | | | | II | 79 | 11.3 | 12 |
| | | | | | | | | III | 379 | | |
| 42 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 150 | 1.97 | 1.97 |
| | | | | | | | | II | 11.1 | 2.78 | 4.75 |
| | | | | | | | | III | 1592 | 3.46 | 8.21 |
| | | | | | | | | IV | 227 | | |
| 43 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 83.2 | 4.02 | 4.02 |
| | | | | | | | | II | 310 | 4.96 | 8.98 |
| | | | | | | | | III | 83.5 | 35.8 | 44.8 |
| | | | | | | | | IV | 41.4 | 55.2 | 100 |
| | | | | | | | | V | 135 | | |
| 44 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 67.4 | 4.02 | 4.02 |
| | | | | | | | | II | 181 | 4.96 | 8.98 |
| | | | | | | | | III | 15.3 | 11.1 | 20.1 |
| | | | | | | | | IV | 74.1 | | |
| 45 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 64.24 | 3.333 | 3.333 |
| | | | | | | | | II | 44.04 | 34.8 | 38.14 |
| | | | | | | | | III | 74.08 | | |
| 46 | Sangli | | Jath | Open field | 17°02'16"N | 75°27'56"E | | I | 39.2 | 4.78 | 4.78 |
| | | | | | | | | II | 263 | 20.8 | 25.5 |
| | | | | | | | | III | 14.3 | 57.9 | 83.4 |
| | | | | | | | | IV | 2664 | | |

**Annexure-XII** Coordinates of Proposed Recharge Structure

*(CD=Check Dam, RS=Recharge Shaft)

| S No. | Name | DISTRICT | TALUKA | VILLAGE | LONGITUDE | LATTITUDE |
|---|---|---|---|---|---|---|
| 1 | CD with RS | Sangli | Jath | Gugwad | 75.147569 | 16.884487 |
| 2 | CD with RS | Sangli | Jath | Gugwad | 75.152248 | 16.896964 |
| 3 | CD with RS | Sangli | Jath | Umarani | 75.225044 | 16.899574 |
| 4 | CD with RS | Sangli | Jath | Umarani | 75.226635 | 16.900403 |
| 5 | CD with RS | Sangli | Jath | Umarani | 75.228118 | 16.902882 |
| 6 | CD with RS | Sangli | Jath | Basargi | 75.183521 | 16.9043 |
| 7 | CD with RS | Sangli | Jath | Umarani | 75.219503 | 16.907166 |
| 8 | CD with RS | Sangli | Jath | Umarani | 75.229828 | 16.907572 |
| 9 | CD with RS | Sangli | Jath | Umarani | 75.219326 | 16.910129 |
| 10 | CD with RS | Sangli | Jath | Ekundi | 75.099465 | 16.9248 |
| 11 | CD with RS | Sangli | Jath | Khojanwadi | 75.243027 | 16.935846 |
| 12 | CD with RS | Sangli | Jath | Singnapur | 75.045929 | 16.944241 |
| 13 | CD with RS | Sangli | Jath | Bilur | 75.180284 | 16.948088 |
| 14 | CD with RS | Sangli | Jath | Bilur | 75.221263 | 16.951731 |
| 15 | CD with RS | Sangli | Jath | Khojanwadi | 75.248002 | 16.952371 |
| 16 | CD with RS | Sangli | Jath | Bilur | 75.218032 | 16.95494 |
| 17 | CD with RS | Sangli | Jath | Bilur | 75.216663 | 16.957882 |
| 18 | CD with RS | Sangli | Jath | Bilur | 75.161351 | 16.959448 |
| 19 | CD with RS | Sangli | Jath | Salmalgewadi | 75.156748 | 16.96269 |
| 20 | CD with RS | Sangli | Jath | Bilur | 75.18316 | 16.963217 |
| 21 | CD with RS | Sangli | Jath | Kudnur | 75.034607 | 16.963896 |
| 22 | CD with RS | Sangli | Jath | Jirgyal | 75.11614 | 16.966719 |
| 23 | CD with RS | Sangli | Jath | Dhulkarwadi | 75.506087 | 16.968226 |
| 24 | CD with RS | Sangli | Jath | Muchandi | 75.356607 | 16.97232 |
| 25 | CD with RS | Sangli | Jath | Untwadi | 75.273019 | 16.974288 |
| 26 | CD with RS | Sangli | Jath | Ravalgundwadi | 75.300687 | 16.977454 |
| 27 | CD with RS | Sangli | Jath | Dafalapur | 75.080173 | 16.978664 |
| 28 | CD with RS | Sangli | Jath | Yeldari | 75.185293 | 16.979549 |
| 29 | CD with RS | Sangli | Jath | Konbagi | 75.61294 | 16.979552 |
| 30 | CD with RS | Sangli | Jath | Muchandi | 75.334265 | 16.979844 |
| 31 | CD with RS | Sangli | Jath | Ravalgundwadi | 75.306732 | 16.981086 |
| 32 | CD with RS | Sangli | Jath | Mirawad | 75.105916 | 16.983991 |
| 33 | CD with RS | Sangli | Jath | Kaganari | 75.538182 | 16.988012 |
| 34 | CD with RS | Sangli | Jath | Muchandi | 75.35563 | 16.989389 |
| 35 | CD with RS | Sangli | Jath | Yeldari | 75.186152 | 16.989878 |
| 36 | CD with RS | Sangli | Jath | Siddhanath | 75.419537 | 16.990472 |
| 37 | CD with RS | Sangli | Jath | Muchandi | 75.320087 | 16.992198 |

| S No. | Name | DISTRICT | TALUKA | VILLAGE | LONGITUDE | LATTITUDE |
|---|---|---|---|---|---|---|
| 38 | CD with RS | Sangli | Jath | Asangi Turk | 75.498422 | 16.992402 |
| 39 | CD with RS | Sangli | Jath | Dafalapur | 75.079737 | 16.993813 |
| 40 | CD with RS | Sangli | Jath | Siddhanath | 75.434366 | 16.995232 |
| 41 | CD with RS | Sangli | Jath | Kaganari | 75.548349 | 16.995265 |
| 42 | CD with RS | Sangli | Jath | Dafalapur | 75.073362 | 16.996622 |
| 43 | CD with RS | Sangli | Jath | Mendhegiri | 75.243028 | 16.999039 |
| 44 | CD with RS | Sangli | Jath | Mendhegiri | 75.248274 | 17.000692 |
| 45 | CD with RS | Sangli | Jath | Dafalapur | 75.099917 | 17.003488 |
| 46 | CD with RS | Sangli | Jath | Devnal | 75.257235 | 17.005935 |
| 47 | CD with RS | Sangli | Jath | Jalyal Kh | 75.446854 | 17.007985 |
| 48 | CD with RS | Sangli | Jath | Pandharewadi | 75.474182 | 17.012091 |
| 49 | CD with RS | Sangli | Jath | Tikondi | 75.574564 | 17.012544 |
| 50 | CD with RS | Sangli | Jath | Muchandi | 75.326594 | 17.012609 |
| 51 | CD with RS | Sangli | Jath | Dafalapur | 75.09245 | 17.014084 |
| 52 | CD with RS | Sangli | Jath | Motewadi | 75.522313 | 17.017894 |
| 53 | CD with RS | Sangli | Jath | Mailal | 75.213511 | 17.020018 |
| 54 | CD with RS | Sangli | Jath | Karewadi | 75.623808 | 17.021412 |
| 55 | CD with RS | Sangli | Jath | Darikonur | 75.383932 | 17.022367 |
| 56 | CD with RS | Sangli | Jath | Jath | 75.254035 | 17.026124 |
| 57 | CD with RS | Sangli | Jath | Darikonur | 75.390165 | 17.026267 |
| 58 | CD with RS | Sangli | Jath | Jath | 75.258297 | 17.027947 |
| 59 | CD with RS | Sangli | Jath | Khandnal | 75.483362 | 17.028964 |
| 60 | CD with RS | Sangli | Jath | Tikondi | 75.57001 | 17.029745 |
| 61 | CD with RS | Sangli | Jath | Salekari | 75.288297 | 17.030397 |
| 62 | CD with RS | Sangli | Jath | Gulgunjnal | 75.654438 | 17.030543 |
| 63 | CD with RS | Sangli | Jath | Daribadachi | 75.407788 | 17.031191 |
| 64 | CD with RS | Sangli | Jath | Amrutwadi | 75.270381 | 17.032262 |
| 65 | CD with RS | Sangli | Jath | Pandozari | 75.515027 | 17.033511 |
| 66 | CD with RS | Sangli | Jath | Belunki | 75.084832 | 17.033889 |
| 67 | CD with RS | Sangli | Jath | Rampur | 75.176709 | 17.034368 |
| 68 | CD with RS | Sangli | Jath | Daribadachi | 75.416543 | 17.034496 |
| 69 | CD with RS | Sangli | Jath | Karewadi (Ko) | 75.55988 | 17.035773 |
| 70 | CD with RS | Sangli | Jath | Daribadachi | 75.433744 | 17.039872 |
| 71 | CD with RS | Sangli | Jath | Belunki | 75.100129 | 17.040019 |
| 72 | CD with RS | Sangli | Jath | Baj | 75.062339 | 17.040394 |
| 73 | CD with RS | Sangli | Jath | Shedyal | 75.321252 | 17.041679 |
| 74 | CD with RS | Sangli | Jath | Rampur | 75.182452 | 17.043326 |
| 75 | CD with RS | Sangli | Jath | Daribadachi | 75.437259 | 17.043529 |
| 76 | CD with RS | Sangli | Jath | Washan | 75.150479 | 17.044206 |
| 77 | CD with RS | Sangli | Jath | Lamantanda | 75.452768 | 17.047549 |

| S No. | Name | DISTRICT | TALUKA | VILLAGE | LONGITUDE | LATTITUDE |
|---|---|---|---|---|---|---|
| 78 | CD with RS | Sangli | Jath | Lavanga | 75.638914 | 17.048464 |
| 79 | CD with RS | Sangli | Jath | Jalyal Bk | 75.606423 | 17.050103 |
| 80 | CD with RS | Sangli | Jath | Shedyal | 75.341828 | 17.051185 |
| 81 | CD with RS | Sangli | Jath | Baj | 75.072091 | 17.053829 |
| 82 | CD with RS | Sangli | Jath | Jath | 75.213007 | 17.053904 |
| 83 | CD with RS | Sangli | Jath | Baj | 75.055708 | 17.056618 |
| 84 | CD with RS | Sangli | Jath | Walsang | 75.319441 | 17.057382 |
| 85 | CD with RS | Sangli | Jath | Walsang | 75.323449 | 17.058141 |
| 86 | CD with RS | Sangli | Jath | Jath | 75.22961 | 17.058253 |
| 87 | CD with RS | Sangli | Jath | Jath | 75.212422 | 17.058499 |
| 88 | CD with RS | Sangli | Jath | Sankh | 75.471727 | 17.059515 |
| 89 | CD with RS | Sangli | Jath | Sordi | 75.387979 | 17.061558 |
| 90 | CD with RS | Sangli | Jath | Bhivargi | 75.579014 | 17.0635 |
| 91 | CD with RS | Sangli | Jath | Sankh | 75.478603 | 17.064149 |
| 92 | CD with RS | Sangli | Jath | Jath | 75.207723 | 17.064448 |
| 93 | CD with RS | Sangli | Jath | Tilyal | 75.430009 | 17.066111 |
| 94 | CD with RS | Sangli | Jath | Dorli | 75.001128 | 17.066734 |
| 95 | CD with RS | Sangli | Jath | Walsang | 75.341164 | 17.068037 |
| 96 | CD with RS | Sangli | Jath | Sankh | 75.506648 | 17.068777 |
| 97 | CD with RS | Sangli | Jath | Bhivargi | 75.590766 | 17.071348 |
| 98 | CD with RS | Sangli | Jath | Sordi | 75.377747 | 17.071648 |
| 99 | CD with RS | Sangli | Jath | Sankh | 75.514229 | 17.071939 |
| 100 | CD with RS | Sangli | Jath | Sankh | 75.495009 | 17.074463 |
| 101 | CD with RS | Sangli | Jath | Bagewadi | 75.124144 | 17.075406 |
| 102 | CD with RS | Sangli | Jath | Dorli | 75.003606 | 17.077914 |
| 103 | CD with RS | Sangli | Jath | Jath | 75.165625 | 17.083274 |
| 104 | CD with RS | Sangli | Jath | Gondhalewadi | 75.471579 | 17.083354 |
| 105 | CD with RS | Sangli | Jath | Asangi Jath | 75.425065 | 17.086674 |
| 106 | CD with RS | Sangli | Jath | Guddapur | 75.373939 | 17.088527 |
| 107 | CD with RS | Sangli | Jath | Birnal | 75.152797 | 17.09122 |
| 108 | CD with RS | Sangli | Jath | Asangi Jath | 75.442511 | 17.094951 |
| 109 | CD with RS | Sangli | Jath | Tippehalli | 75.179057 | 17.094986 |
| 110 | CD with RS | Sangli | Jath | Morbagi | 75.612549 | 17.095583 |
| 111 | CD with RS | Sangli | Jath | Karajanagi | 75.301182 | 17.095887 |
| 112 | CD with RS | Sangli | Jath | Karajanagi | 75.283463 | 17.096448 |
| 113 | CD with RS | Sangli | Jath | Morbagi | 75.609031 | 17.09665 |
| 114 | CD with RS | Sangli | Jath | Bhivargi | 75.562983 | 17.097059 |
| 115 | CD with RS | Sangli | Jath | Achkanhalli | 75.234759 | 17.102072 |
| 116 | CD with RS | Sangli | Jath | Rajobawadi | 75.431657 | 17.103524 |
| 117 | CD with RS | Sangli | Jath | Girgaon | 75.656842 | 17.105035 |

| S No. | Name | DISTRICT | TALUKA | VILLAGE | LONGITUDE | LATTITUDE |
|---|---|---|---|---|---|---|
| 118 | CD with RS | Sangli | Jath | Achkanhalli | 75.241701 | 17.106499 |
| 119 | CD with RS | Sangli | Jath | Kumbhari | 75.099463 | 17.106702 |
| 120 | CD with RS | Sangli | Jath | Kumbhari | 75.118685 | 17.106803 |
| 121 | CD with RS | Sangli | Jath | Karajagi | 75.580132 | 17.111091 |
| 122 | CD with RS | Sangli | Jath | Kolgiri | 75.340882 | 17.112416 |
| 123 | CD with RS | Sangli | Jath | Girgaon | 75.656503 | 17.112552 |
| 124 | CD with RS | Sangli | Jath | Kumbhari | 75.106549 | 17.113195 |
| 125 | CD with RS | Sangli | Jath | Karajagi | 75.571119 | 17.113223 |
| 126 | CD with RS | Sangli | Jath | Kolgiri | 75.341146 | 17.114799 |
| 127 | CD with RS | Sangli | Jath | Nigadi Kh | 75.27132 | 17.116287 |
| 128 | CD with RS | Sangli | Jath | Manik Nal | 75.605351 | 17.116636 |
| 129 | CD with RS | Sangli | Jath | Revnal | 75.194389 | 17.117943 |
| 130 | CD with RS | Sangli | Jath | Kulalwadi | 75.452008 | 17.119448 |
| 131 | CD with RS | Sangli | Jath | Ankalagi | 75.495946 | 17.122143 |
| 132 | CD with RS | Sangli | Jath | Karajagi | 75.579279 | 17.122738 |
| 133 | CD with RS | Sangli | Jath | Kulalwadi | 75.469277 | 17.123748 |
| 134 | CD with RS | Sangli | Jath | Revnal | 75.187691 | 17.12657 |
| 135 | CD with RS | Sangli | Jath | Nigadi Kh | 75.274573 | 17.12788 |
| 136 | CD with RS | Sangli | Jath | Ankalagi | 75.521412 | 17.134309 |
| 137 | CD with RS | Sangli | Jath | Madgyal | 75.411587 | 17.135691 |
| 138 | CD with RS | Sangli | Jath | Sanamadi | 75.343706 | 17.13731 |
| 139 | CD with RS | Sangli | Jath | Madgyal | 75.428607 | 17.141375 |
| 140 | CD with RS | Sangli | Jath | Akkalawadi | 75.621898 | 17.142261 |
| 141 | CD with RS | Sangli | Jath | Maithal | 75.367368 | 17.143373 |
| 142 | CD with RS | Sangli | Jath | Banali | 75.209647 | 17.148931 |
| 143 | CD with RS | Sangli | Jath | Ankalagi | 75.514883 | 17.149072 |
| 144 | CD with RS | Sangli | Jath | Belondgi | 75.580925 | 17.154132 |
| 145 | CD with RS | Sangli | Jath | Gholeshwar | 75.322132 | 17.154488 |
| 146 | CD with RS | Sangli | Jath | Borgi Bk | 75.60922 | 17.154857 |
| 147 | CD with RS | Sangli | Jath | Banali | 75.208744 | 17.154989 |
| 148 | CD with RS | Sangli | Jath | Sonyal | 75.467655 | 17.158488 |
| 149 | CD with RS | Sangli | Jath | Sanamadi | 75.35142 | 17.159262 |
| 150 | CD with RS | Sangli | Jath | Belondgi | 75.582584 | 17.159263 |
| 151 | CD with RS | Sangli | Jath | Lakdewadi | 75.419279 | 17.162699 |
| 152 | CD with RS | Sangli | Jath | Borgi Kh | 75.589085 | 17.165491 |
| 153 | CD with RS | Sangli | Jath | Gulvanchi | 75.084175 | 17.166289 |
| 154 | CD with RS | Sangli | Jath | Kunikonur | 75.358521 | 17.168867 |
| 155 | CD with RS | Sangli | Jath | Ambyachiwadi | 75.373682 | 17.170064 |
| 156 | CD with RS | Sangli | Jath | Antral | 75.21366 | 17.173102 |
| 157 | CD with RS | Sangli | Jath | Gulvanchi | 75.080742 | 17.174163 |

| S No. | Name | DISTRICT | TALUKA | VILLAGE | LONGITUDE | LATTITUDE |
|---|---|---|---|---|---|---|
| 158 | CD with RS | Sangli | Jath | Waifal | 75.238993 | 17.176716 |
| 159 | CD with RS | Sangli | Jath | Tonewadi | 75.332915 | 17.176791 |
| 160 | CD with RS | Sangli | Jath | Bevanur | 75.038527 | 17.177577 |
| 161 | CD with RS | Sangli | Jath | Waifal | 75.263122 | 17.178413 |
| 162 | CD with RS | Sangli | Jath | Shegaon | 75.180159 | 17.18374 |
| 163 | CD with RS | Sangli | Jath | Shegaon | 75.176438 | 17.184133 |
| 164 | CD with RS | Sangli | Jath | Sonyal | 75.471629 | 17.185927 |
| 165 | CD with RS | Sangli | Jath | Sonyal | 75.452484 | 17.185933 |
| 166 | CD with RS | Sangli | Jath | Balgaon | 75.601425 | 17.189016 |
| 167 | CD with RS | Sangli | Jath | Shegaon | 75.173445 | 17.189302 |
| 168 | CD with RS | Sangli | Jath | Sonyal | 75.479106 | 17.189585 |
| 169 | CD with RS | Sangli | Jath | Bevanur | 75.029303 | 17.192915 |
| 170 | CD with RS | Sangli | Jath | Mokashawadi | 75.162081 | 17.193193 |
| 171 | CD with RS | Sangli | Jath | Shegaon | 75.168016 | 17.193808 |
| 172 | CD with RS | Sangli | Jath | Halli | 75.576674 | 17.195021 |
| 173 | CD with RS | Sangli | Jath | Utagi | 75.491937 | 17.196349 |
| 174 | CD with RS | Sangli | Jath | Utagi | 75.51185 | 17.197928 |
| 175 | CD with RS | Sangli | Jath | Halli | 75.600123 | 17.197955 |
| 176 | CD with RS | Sangli | Jath | Yelavi | 75.30264 | 17.199554 |
| 177 | CD with RS | Sangli | Jath | Utagi | 75.51142 | 17.20043 |
| 178 | CD with RS | Sangli | Jath | Balgaon | 75.618339 | 17.2009 |
| 179 | CD with RS | Sangli | Jath | Utagi | 75.514273 | 17.202172 |
| 180 | CD with RS | Sangli | Jath | Utagi | 75.518754 | 17.204016 |
| 181 | CD with RS | Sangli | Jath | Yelavi | 75.31405 | 17.205182 |
| 182 | CD with RS | Sangli | Jath | Khairao | 75.348139 | 17.207915 |
| 183 | CD with RS | Sangli | Jath | Suslad | 75.630586 | 17.215855 |
| 184 | CD with RS | Sangli | Jath | Utagi | 75.5201 | 17.215887 |
| 185 | CD with RS | Sangli | Jath | Bevanur | 75.021823 | 17.217615 |
| 186 | CD with RS | Sangli | Jath | Khairao | 75.355696 | 17.217833 |
| 187 | CD with RS | Sangli | Jath | Walekhindi | 75.139804 | 17.222144 |
| 188 | CD with RS | Sangli | Jath | Singanhalli | 75.145464 | 17.222168 |
| 189 | CD with RS | Sangli | Jath | Jadraboblad | 75.429951 | 17.222726 |
| 190 | CD with RS | Sangli | Jath | Avandhi | 75.202968 | 17.2234 |
| 191 | CD with RS | Sangli | Jath | Nigadi Bk | 75.534023 | 17.223802 |
| 192 | CD with RS | Sangli | Jath | Walekhindi | 75.140391 | 17.223837 |
| 193 | CD with RS | Sangli | Jath | Walekhindi | 75.105388 | 17.224617 |
| 194 | CD with RS | Sangli | Jath | Walekhindi | 75.128348 | 17.225414 |
| 195 | CD with RS | Sangli | Jath | Nigadi Bk | 75.537614 | 17.22638 |
| 196 | CD with RS | Sangli | Jath | Jadraboblad | 75.431349 | 17.226527 |
| 197 | CD with RS | Sangli | Jath | Navalwadi | 75.095912 | 17.227073 |

| S No. | Name | DISTRICT | TALUKA | VILLAGE | LONGITUDE | LATTITUDE |
|---|---|---|---|---|---|---|
| 198 | CD with RS | Sangli | Jath | Singanhalli | 75.152042 | 17.228814 |
| 199 | CD with RS | Sangli | Jath | Umadi | 75.549496 | 17.230449 |
| 200 | CD with RS | Sangli | Jath | Avandhi | 75.198331 | 17.231084 |
| 201 | CD with RS | Sangli | Jath | Umadi | 75.55739 | 17.231128 |
| 202 | CD with RS | Sangli | Jath | Umadi | 75.553148 | 17.231299 |
| 203 | CD with RS | Sangli | Jath | Suslad | 75.635779 | 17.231844 |
| 204 | CD with RS | Sangli | Jath | Jadraboblad | 75.440201 | 17.234087 |
| 205 | CD with RS | Sangli | Jath | Umadi | 75.561341 | 17.235868 |
| 206 | CD with RS | Sangli | Jath | Jadraboblad | 75.442593 | 17.239201 |
| 207 | CD with RS | Sangli | Jath | Sonalagi | 75.636745 | 17.246656 |
| 208 | CD with RS | Sangli | Jath | Lohagaon | 75.214791 | 17.252782 |
| 209 | CD with RS | Sangli | Jath | Lohagaon | 75.204802 | 17.25919 |
| 210 | CD with RS | Sangli | Jath | Umadi | 75.620074 | 17.266998 |
| 211 | CD with RS | Sangli | Jath | Vithalwadi | 75.576834 | 17.267734 |
| 212 | CD with RS | Sangli | Jath | Vithalwadi | 75.574466 | 17.268087 |
| 213 | CD with RS | Sangli | Jath | Umadi | 75.62297 | 17.26947 |

**Annessure XIII:** Ground Water Exploration Data of Jath Block, Sangli District

**Exploration/ Pumping Test Data of Jath Block, Sangli District**

| SN | Location | Latitude | Longitude | Well Type | Overburden casing | Casing pipe length | Total Depth of well | Major Lithology | Zones /Fractured encountered (m bgl) | | | SWL (mbgl) | Discharge (lps) | Specific Capacity ( | Drawdown (m) | Trransmissivity (m2/d) | Storativity |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Zone 1 | Zone 2 | Zone 3 | | | | | | |
| 1 | Bevanur | 17.205 | 75.04215 | EW | 177.8 | 20.5 | 200 | Basalt | dry | | | | Merger | | | | |
| 2 | Hivare | 17.1012 | 75.05739 | EW | 177.8 | 24 | 200 | Basalt | 22.6-25.7 | 80.6- | 35.5-138.5 | 8.1 | 4.43 | 8.46 | 48.31 | 2.65 | 6.52E-05 |
| 3 | Hivare | 17.1012 | 75.05728 | OW | 177.8 | 24 | 150.7 | Basalt | 22.6-25. | 80.6- | 35.5-138.5 | 4.8 | 4.43 | | 4.77 | 26.5689 | 1.22E-04 |
| 4 | Dafalapur | 17.0001 | 75.07076 | EW | 177.8 | 42 | 200 | Basalt | | | 193-196 | 36 | 0.025 | | | | |
| 5 | Sindhur | 16.8707 | 75.21176 | EW | 177.8 | 21 | 200 | Basalt | | | 166-169 | 34 | 0.025 | | | | |
| 6 | Yeldhari | 16.9882 | 75.187 | EW | 177.8 | 21 | 200 | Basalt | 13-15 | 71-74 | | 56 | 0.025 | | | | |
| 7 | Jath | 17.0485 | 75.20788 | EW | 177.8 | 15.5 | 200 | Basalt | 13-15 | 74-76 | | 26 | 4.43 | 17.83 | 9.44 | 36.7864 | 1.84E-05 |
| 8 | Jath | 17.0484 | 75.20787 | OW | 177.8 | 15.5 | 200 | Basalt | 13-15, | 74-77 | | 23 | 4.43 | | 7.01 | 33.8822 | 3.14E-04 |
| 9 | Asangi Turk | 17.0008 | 75.50709 | EW | 177.8 | 15.5 | 200 | Basalt | 44-47, | | 162-166 | 13 | 0.14 | | | | |
| 10 | Tilyal | 17.065 | 75.43184 | EW | 177.8 | 20.5 | 200 | Basalt | | 72-74 | | 36 | 0.14 | | | | |
| 11 | Sonyal | 17.1757 | 75.4548 | EW | 177.8 | 20.5 | 200 | Basalt | DRY | | | | | | | | |
| 12 | Morbagi | 17.0933 | 75.61037 | EW | 177.8 | 20.5 | 200 | Basalt | | | 171-174 | 30 | 0.14 | | | | |
| 13 | Singanhalli | 17.2242 | 75.15408 | Pz | 177.8 | 20.5 | 120 | Basalt | 7-8, | 77.50-80.60 | | 7 | 0.14 | | | | |

# Annexure- XIV Farmer's Feedback

2

## Annexure -III

### Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Damu Ramu Chauhan | | |
| Village | Nigadi BU | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Nigadi Budruk, Jath, Sangli | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | 1 BW (Bore well) | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | | | |
| Drill time discharge (lps) | – | | |
| Depth of installation of pump | 400 ft total depth - 500 ft | | |
| Casing depth (Bore wells) HR | 40 ft | | |
| Fracture encountered depth-HR | | | |
| Slotted pipe depths (TW) SR | – | | |
| Average water levels – pre-monsoon | 350 ft | | |
| Average water levels – post-monsoon | 50 ft to 100 ft | | |
| The well is used for | irrigation | | |
| Is water available throughout the year | Yes (dry spell in may & June) | | |
| If not for how many months water is available | may & June | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | Grapes | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | — | | |
| Others (no of months to be specified) | — | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 1.25 acre | Pomegranate | |
| Kharif (no of months to be specified) | 2 acre | Grapes | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Pomegranate | | |
| Area under crop | Grapes | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Pomogranate | | |
| Area under crop | Grapes | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | — | | |
| Available Market for the crop | — | | |
| Average unit cost of production | – | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected | | |
| Other subsidies, facilities, restrictions. | Subsidy for micro-irrigation | | |
| **Source of Energy** | | | |
| Solar No | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>● Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi----- | | |
| Diesel | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

| Water Market* No | o Do you share the pumped water with other farmers<br>o If yes<br>o For how many days do you share pumped water in Kharif<br>o For how many days do you share pumped water in Rabi Period<br>o On an average how much do you charge per annum (in Rs) |
|---|---|
| No | o Do you receive additional water from boreholes of nearby farmers<br>o If yes<br>o For how many days do you receive pumped water in Kharif<br>o For how many days do you receive pumped water in Rabi Period<br>o On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

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# Annexure -III

## Farmer Feedback Form

Photograph

| | | |
|---|---|---|
| Name | Priyanka Mahadev Mali | |
| Village | | |
| Block | Jath | |
| District | Sangli | |
| Address | | |
| Mobile Number (optional) | 8088010489 | |
| **Type and number of structures** | | |
| Type | BW, DW | |
| Number | 2 | |
| (coordinates of the structures are to be obtained by the field officer) | – | |
| Drill time discharge (lps) | – | |
| Depth of installation of pump | – | |
| Casing depth (Bore wells) HR | – | |
| Fracture encountered depth-HR | 6 mt | |
| Slotted pipe depths (TW) SR | – | |
| Average water levels – pre-monsoon | DW - dry | |
| Average water levels – post-monsoon | DW - 4 mt | |
| The well is used for | irrigation & drinking purpose | |
| Is water available throughout the year | No | |
| If not for how many months water is available | June & may | |

| **Pumping Duration** | | | |
|---|---|---|---|
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 3 to 4 | Months | |
| Others (no of months to be specified) | 3 to 4 Months | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 2 acre | Wheat | |
| Khariff (no of months to be specified) | | Jowar | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar | Wheat | |
| Area under crop | 2.5 acre | 2 acre | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar | Wheat | |
| Area under crop | 2.5 acre | 2 acre | |
| Reasons for change in cropping pattern in last 20 years. | No change | — | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | • Pomegranate<br>• Grapes | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Jowar - 3180 \| Wheat - 2125 | | |
| Other subsidies, facilities, restrictions. | No | | |
| **Source of Energy** | | | |
| Solar No | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric No | ○ Do you get free electricity for irrigation?<br>● Do you pay a fixed charge Yes<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif---<br>○ During Rabi----- | | |
| Diesel No | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

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| | | |
|---|---|---|
| **Water Market*** | No | ○ Do you share the pumped water with other farmers<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
| | | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | | e.g. common problems in drilling of wells, common health issues in the area etc |

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

Mob. No.- 8055010489

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# Annexure -III

## Farmer Feedback Form

| | | | Photograph |
|---|---|---|---|
| Name | Yashwant Ganapule 9561998297 | | |
| Village | Sudad | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Sudad, Jath, Sangli | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | 2 DW 1 BW | | |
| Number | 3 | | |
| (coordinates of the structures are to be obtained by the field officer) | – | | |
| Drill time discharge (lps) | - | | |
| Depth of installation of pump | - | | |
| Casing depth (Bore wells) HR | – | | |
| Fracture encountered depth-HR | - | | |
| Slotted pipe depths (TW) SR | – | | |
| Average water levels – pre-monsoon | BW-500Ft DW- 18mt | | |
| Average water levels – post-monsoon | BW-300 Ft DW- 8mt | | |
| The well is used for | Irrigation / Drinking | | |
| Is water available throughout the year | Yes (Yes) | | |
| If not for how many months water is available | – | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | | |

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| | |
|---|---|
| **Water Market*** No | ○ Do you share the pumped water with other farmers<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
| | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

1 acre - grapes
Fallow land due to less water

- Sankh Pradip + Jan-dry
less water
Medium irrigation

25

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Savitri Kharat | | |
| Village | Kulalwadi | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Kulalwadi, Jath, Sangli | | |
| Mobile Number (optional) | - | | |
| **Type and number of structures** | | | |
| Type | DW (60 ft) | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.13654<br>75.45656 | | |
| Drill time discharge (lps) | | | |
| Depth of installation of pump | 5HP, Motor | | |
| Casing depth (Bore wells) HR | — | | |
| Fracture encountered depth-HR | — | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels – pre-monsoon | 35ft | | |
| Average water levels – post-monsoon | 30ft | | |
| The well is used for | Drinking + irrigation | | |
| Is water available throughout the year | Yes | | |
| If not for how many months water is available | — | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | — | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | – | | |
| Others (no of months to be specified) | – | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | NA | | |
| Khariff (no of months to be specified) | 3 to 4 mothe | | |
| Others (no of months to be specified) | NA | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Bajra, Jowar – | | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Bajra Jowar | | |
| Area under crop | 2 ac 2 acre | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | NA | | |
| Available Market for the crop | – | | |
| Average unit cost of production | – | | |
| Average unit cost of selling | – | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Bajra - 2500, Jowar - 3010 | | |
| Other subsidies, facilities, restrictions. | NO | | |
| **Source of Energy** | | | |
| Solar NO | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>○ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi—— | | |
| Diesel NO | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

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| Water Market* No | ○ Do you share the pumped water with other farmers<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
|---|---|
| | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |
| - Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study. | |

→ Fluoride - in BW

→ Bajari / Jowari

→

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# Annexure -III

(1)

## Farmer Feedback Form

| | Photograph |
|---|---|
| Name | Kundu Rao Tille |
| Village | Utagi |
| Block | Jath |
| District | Sangli |
| Address | Utagi village, Jath, Sangli |
| Mobile Number (optional) | 7066831084 |

| **Type and number of structures** | | |
|---|---|---|
| Type | BW | |
| Number | 1 | |
| (coordinates of the structures are to be obtained by the field officer) | | |
| Drill time discharge (lps) | 3 Inch / 4 hrs | |
| Depth of installation of pump | 180 mt | |
| Casing depth (Bore wells) HR | 20 mt | |
| Fracture encountered depth-HR | 60 ft | |
| Slotted pipe depths (TW) SR | – | – |
| Average water levels – pre-monsoon | | |
| Average water levels – post-monsoon | | |
| The well is used for | Domestic Use | |
| Is water available throughout the year | Yes | |
| If not for how many months water is available | – | |

| **Pumping Duration** | | | |
|---|---|---|---|
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | 30 days | 4 | 10 ltr- Bucket<br>Jul-12-15 |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 3 to 4 months | | |
| Others (no of months to be specified) | 3 to 4 months | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 5 acre | Bajra | |
| Kharif (no of months to be specified) | 5 acre | Toor Jowar | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Toor, Jowari | Bajra | Sugarcane |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Toor Jowari | | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years | No change in cropping pattern | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | | | |
| Available Market for the crop | | | |
| Average unit cost of production | | | |
| Average unit cost of selling | | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Jowar - 3180 | Bajra - 2500 | Maize - 2090 |
| Other subsidies, facilities, restrictions | | | |
| **Source of Energy** | | | |
| Solar NA | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>○ Do you pay a fixed charge<br>✔ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi----- | | |
| Diesel | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

24

| | |
|---|---|
| **Water Market*** No | o Do you share the pumped water with other farmers<br>o If yes<br>o For how many days do you share pumped water in Kharif<br>o For how many days do you share pumped water in Rabi Period<br>o On an average how much do you charge per annum (in Rs) |
| | o Do you receive additional water from boreholes of nearby farmers<br>o If yes<br>o For how many days do you receive pumped water in Kharif<br>o For how many days do you receive pumped water in Rabi Period<br>o On an average how much do you pay per annum (in Rs) |
| **Other Issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |
| - Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas. Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study. | |

Mobile - 7066370544

25

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 3 to 4 months | | |
| Others (no of months to be specified) | 3 to 4 months | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 3 to 4 mothns | | |
| Khariff (no of months to be specified) | 3 to 4 months | | |
| Others (no of months to be specified) | 3 to 4 moth | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar, Corn | Wheat | Grapes Chana |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar, Corn | Wheat | Grapes |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | Grapes Chana | | |
| Available Market for the crop | – | | |
| Average unit cost of production | – | | |
| Average unit cost of selling | – | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Jowar – 3180 / Wheat – 2125 / Maize – 2090 | | |
| Other subsidies, facilities, restrictions. | Subsidy for drip irrigation | | |
| **Source of Energy** | | | |
| Solar NO | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>● Do you pay a fixed charge (every month)<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif---<br>○ During Rabi---- | | |
| Diesel NO | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

14 mt

| | | |
|---|---|---|
| **Water Market*** | No | ○ Do you share the pumped water with other farmers No<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
| | | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | | e.g. common problems in drilling of wells, common health issues in the area etc |
| - Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study. | | |

Grapes - 2
- Sugarcane - Rain - 4
- Chana - green
- Corn - Makka } 2 [illegible]
- Jowar
- Wheat
- drip irrigation

BW depth 750
- DW - depth + 20mt
  + 20mt
-

5

# Annexure -III

## Farmer Feedback Form

| | | |
|---|---|---|
| | | Photograph |
| Name | Balchandra Hoxhi | |
| Village | Umadi | |
| Block | Jath, | |
| District | Sangli | |
| Address | Umadi, Jath, Sangli | |
| Mobile Number (optional) | 7745 843373 | |
| **Type and number of structures** | | |
| Type | 2 BW 1 storage Tank - Farm | |
| Number | 1 | |
| (coordinates of the structures are to be obtained by the field officer) | 900 ft<br>— | |
| Drill time discharge (lps) | 1 Inch - | |
| Depth of installation of pump | 800 ft (7.5 hp) | |
| Casing depth (Bore wells) HR | 900 ft | |
| Fracture encountered depth-HR | — | |
| Slotted pipe depths (TW) SR | — | |
| Average water levels – pre-monsoon | 700 ft | |
| Average water levels – post-monsoon | 550 ft | |
| The well is used for | irrigation | |
| Is water available throughout the year | Yes | |
| If not for how many months water is available | — | |

| **Pumping Duration** | | | |
|---|---|---|---|
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 4 acre - Jowar / Bajari | | |
| Khariff (no of months to be specified) | 4 acre - Grapes → Drip | | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar, Bajar | | Grapes |
| Area under crop | 4 acre | | 4 acre |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar, Bajra | | Grapes |
| Area under crop | 4 acre | | 4 acre |
| Reasons for change in cropping pattern in last 20 years | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | More area in grapes | | |
| Available Market for the crop | — | | |
| Average unit cost of production | - | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Jowar - 3180 \| Bajara - 2500 | | |
| Other subsidies, facilities, restrictions | for micro irrigation | | |
| **Source of Energy** | | | |
| Solar NO | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>✔ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi----- | | |
| Diesel NO | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

24

| | |
|---|---|
| **Water Market*** NO | o Do you share the pumped water with other farmers<br>o If yes<br>o For how many days do you share pumped water in Kharif<br>o For how many days do you share pumped water in Rabi Period<br>o On an average how much do you charge per annum (in Rs) |
| | o Do you receive additional water from boreholes of nearby farmers<br>o If yes<br>o For how many days do you receive pumped water in Kharif<br>o For how many days do you receive pumped water in Rabi Period<br>o On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |
| - Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study. | |

→ 7745843373

25

6

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Parshuram Male | | |
| Village | Balgaon | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Balgaon, Jath, Sangli | | |
| Mobile Number (optional) | 7821885090 | | |
| **Type and number of structures** | | | |
| Type | BW | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | | | |
| Drill time discharge (lps) | 2 to 3 km | | |
| Depth of installation of pump | 700 / 5HP Pump | | |
| Casing depth (Bore wells) HR | 700 | | |
| Fracture encountered depth-HR | | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels – pre-monsoon | 550 ft | | |
| Average water levels – post-monsoon | 300 ft | | |
| The well is used for | irrigation & drinking | | |
| Is water available throughout the year | Yes | | |
| If not for how many months water is available | — | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | — | | |
| Others (no of months to be specified) | — | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | — | | |
| Khariff (no of months to be specified) | - | | |
| Others (no of months to be specified) | all year round | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar Bajari | | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Berries (Indian Jujube) | | |
| Area under crop | 2-4 acre | | |
| Reasons for change in cropping pattern in last 20 years. | water scarcity | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | — NA | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected | | |
| Other subsidies, facilities, restrictions. | No subsidies | | |
| **Source of Energy** | | | |
| Solar NO | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>● Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi----- | | |
| Diesel NO | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

24

| | | |
|---|---|---|
| **Water Market*** | NO | ○ Do you share the pumped water with other farmers<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
| | | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | | e.g. common problems in drilling of wells, common health issues in the area etc |

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

7821885090

1.5

700 -

drinking water -

25

7

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Siddharam Fashuwalkatte | | |
| Village | Utagi | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Utagi, Jath, Sangli | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | BW | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.199588°<br>75.599825 | | |
| Drill time discharge (lps) | | | |
| Depth of installation of pump | 480 ft | | |
| Casing depth (Bore wells) HR | 400 ft | | |
| Fracture encountered depth-HR | | | |
| Slotted pipe depths (TW) SR | — | | |
| Average water levels – pre-monsoon | 350 ft | | |
| Average water levels – post-monsoon | 250 ft | | |
| The well is used for | irrigation & drinking | | |
| Is water available throughout the year | | | |
| If not for how many months water is available | all time available | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | — | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 3 - 4 months | | |
| Others (no of months to be specified) | all year | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | — | | |
| Kharif (no of months to be specified) | 3 - 4 mnths | | |
| Others (no of months to be specified) | all year | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowari | | |
| Area under crop | 0.5 Acre | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowari | | Pomogranate, Jujube |
| Area under crop | | | 3.50 acre |
| Reasons for change in cropping pattern in last 20 years. | water scarcity | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | Indian jujube which are already existing in 2.5 acre | | |
| Available Market for the crop | - | | |
| Average unit cost of production | - | | |
| Average unit cost of selling | - | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Jowari - 3010 | | |
| Other subsidies, facilities, restrictions | Micro-irrigation subsidy | | |
| **Source of Energy** | | | |
| Solar NO | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>✓ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi----- | | |
| Diesel NO | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

24

| | |
|---|---|
| **Water Market*** No | ○ Do you share the pumped water with other farmers<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
| | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |
| - Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study. | |

3.5 Acre : Bor
Pomegranate
Jowari
drip

25

8

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Bandgi Mehboob Nadaf | | |
| Village | Kalajgi | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Kalajgi, Jath, Sangli | | |
| Mobile Number (optional) | 7498011355 | | |
| **Type and number of structures** | | | |
| Type | BW (depth - 450 ft) | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.1282<br>75.533672 | | |
| Drill time discharge (lps) | 5 inch | | |
| Depth of installation of pump | 430 ft (5 HP Motor) | | |
| Casing depth (Bore wells) HR | 32 ft | | |
| Fracture encountered depth-HR | 80 ft | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels - pre-monsoon | 70 - 80 ft | | |
| Average water levels – post-monsoon | 100 ft | | |
| The well is used for | Irrigation & domestic use | | |
| Is water available throughout the year | Yes | | |
| If not for how many months water is available | N A | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | — | | |

23

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | | | |
| Khariff (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar | | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | 2 acre for fodder crop | | Pomogranate, Lemon |
| Area under crop | | | 0.75, 0.5 |
| Reasons for change in cropping pattern in last 20 years. | water scarcity & Animal husbandary | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | — | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Jowar – 3010 | | |
| Other subsidies, facilities, restrictions. | Subsidy for micro irrigation (drip) | | |
| **Source of Energy** | | | |
| Solar No | ○ Is it connected to grid No<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation?<br>✓ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif----<br>○ During Rabi---- | | |
| Diesel NO | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

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| | | |
|---|---|---|
| **Water Market*** | No | o Do you share the pumped water with other farmers<br>o If yes<br>o For how many days do you share pumped water in Kharif<br>o For how many days do you share pumped water in Rabi Period<br>o On an average how much do you charge per annum (in Rs) |
| | | o Do you receive additional water from boreholes of nearby farmers<br>o If yes<br>o For how many days do you receive pumped water in Kharif<br>o For how many days do you receive pumped water in Rabi Period<br>o On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | | e.g. common problems in drilling of wells, common health issues in the area etc |
| - Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study. | | |

0.75- Acre. Pomegranate | 7498011355.
1/2 - Acre Lemon

2 Acre

before - fodder
Now - fruit

9

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Rajgonda Bapu Patil | | |
| Village | Sanikh | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | Sankh, Jath, Sangli | | |
| Mobile Number (optional) | 9403005222 | | |
| **Type and number of structures** | | | |
| Type | DW / BW | 500 ft / 300 ft | |
| Number | 1 2 | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.088848<br>75.498443 | | |
| Drill time discharge (lps) | | | |
| Depth of installation of pump | 3 | | |
| Casing depth (Bore wells) HR | 3 mt | | |
| Fracture encountered depth-HR | | | |
| Slotted pipe depths (TW) SR | — | | |
| Average water levels – pre-monsoon | Dry | | |
| Average water levels – post-monsoon | 45 ft | | EC- 2017 |
| The well is used for | Irrigation & drinking | | |
| Is water available throughout the year | 8 months running | | |
| If not for how many months water is available | 4 months | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | — | | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | — | | |
| Others (no of months to be specified) | all year | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 3 to 4 months | | |
| Khariff (no of months to be specified) | 3 to 4 months | | |
| Others (no of months to be specified) | all year | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jawar, Bajara | | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar, Bajara | Toor | Pomogranate, Peru |
| Area under crop | 3 acre | 2 acre | 1.5 acre, 2 acre |
| Reasons for change in cropping pattern in last 20 years | • More knowledge to farmer | | Sugarcane - 0.5 acre Custard appl - 0.25 |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | NA | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | - | | |
| Existing MSP and other related information | Crop wise details are to be collected | | |
| Other subsidies, facilities, restrictions. | Drip Subsidy - 60% Solar Subsidy - 80% | | |
| **Source of Energy** | | | |
| Solar Yes | ○ Is it connected to grid (applied) - ○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ○ Do you get free electricity for irrigation? ✓ Do you pay a fixed charge ○ If a fixed charge is paid, what is the per month charge ○ If unit-based charges are paid what is the average monthly charges in rupees ○ During kharif---- ○ During Rabi----- | | |
| Diesel No | ○ Average consumption of diesel (liters) per month ○ During Kharif ○ During Rabi | | |

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| Water Market* No | ○ Do you share the pumped water with other farmers<br>○ If yes<br>○ For how many days do you share pumped water in Kharif<br>○ For how many days do you share pumped water in Rabi Period<br>○ On an average how much do you charge per annum (in Rs) |
|---|---|
| | ○ Do you receive additional water from boreholes of nearby farmers<br>○ If yes<br>○ For how many days do you receive pumped water in Kharif<br>○ For how many days do you receive pumped water in Rabi Period<br>○ On an average how much do you pay per annum (in Rs) |
| **Other issues/Remarks** | e.g. common problems in drilling of wells, common health issues in the area etc |

- Feedback of the local users will form an important input for problem identification and characterization. Feedbacks are to be obtained in case of Urban areas, Industrial clusters also. Feedbacks on drinking water availability, dependence on ground water etc are also to be obtained. The above feedback form can be customized to the type of priority area and objective of the study.

11 acre

Pomogranate → 1.5 acre - drip

Peru → 2 acre - drip

Jowari/ Bajara → 8 acre

Toor → 2 acre

Sugarcane → 0.5 acre

Custard apple → 0.25 acre

25

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# Annexure -III

## Farmer Feedback Form

| | | |
|---|---|---|
| | | Photograph |
| Name | Mallappa Kantappa Rodge | |
| Village | Sankh | |
| Block | Jath | |
| District | Sangli | |
| Address | Sankh, Jath, Sangli | |
| Mobile Number (optional) | 7561415658 | |
| **Type and number of structures** | | |
| Type | BW (500ft) | |
| Number | 1 | |
| (coordinates of the structures are to be obtained by the field officer) | | |
| Drill time discharge (lps) | 1 Inch | |
| Depth of installation of pump | 5HP - 450ft | |
| Casing depth (Bore wells) HR | 50 ft | |
| Fracture encountered depth-HR | 200 ft | |
| Slotted pipe depths (TW) SR | | |
| Average water levels – pre-monsoon | 100 ft | |
| Average water levels – post-monsoon | 200 ft | |
| The well is used for | Irrigation & domestic use / Animal usage | |
| Is water available throughout the year | Yes | |
| If not for how many months water is available | — | |

| **Pumping Duration** | | | |
|---|---|---|---|
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | — | | |

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# Annexure -III

## Farmer Feedback Form

| | | Photograph |
|---|---|---|
| Name | Rajaram prabhakar shinde | |
| Village | Tippehali | |
| Block | Jat | |
| District | Sangli | |
| Address | Tippehali | |
| Mobile Number (optional) | | |
| **Type and number of structures** | | |
| Type | B.W | D.W |
| Number | 1 | 0 |
| (coordinates of the structures are to be obtained by the field officer) | 17.0946961<br>75.1773596 | |
| Drill time discharge (lps) | 2" | |
| Depth of installation of pump | 180ft | |
| Casing depth (Bore wells) HR | 20ft | |
| Fracture encountered depth-HR | 70ft. 120ft | |
| Slotted pipe depths (TW) SR | | |
| Average water levels – pre-monsoon | 40ft | |
| Average water levels – post-monsoon | 20ft | |
| The well is used for | Agriculture | |
| Is water available throughout the year | year | |
| If not for how many months water is available | — | |

| **Pumping Duration** | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
|---|---|---|---|
| Rabi (no of months to be specified) | 4 | 2 hrs | 2" |

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# Annexure -III

## Farmer Feedback Form

| | | |
|---|---|---|
| | | Photograph |
| Name | Sarat Laxman Mate | |
| Village | Pandozi | |
| Block | Jath | |
| District | Sangli | |
| Address | Pandozi | |
| Mobile Number (optional) | — | |
| Type and number of structures | | |
| Type | Borewell | |
| Number | 1 | |
| (coordinates of the structures are to be obtained by the field officer) | 17.028 495<br>75 51226 | |
| Drill time discharge (lps) | 0.78 lps | |
| Depth of installation of pump | 270 ft. | |
| Casing depth (Bore wells) HR | [illegible] | |
| Fracture encountered depth-HR | 83 ft. & 241 ft. | |
| Slotted pipe depths (TW) SR | No | |
| Average water levels – pre-monsoon | 61 ft. | |
| Average water levels – post-monsoon | 213 ft. | |
| The well is used for | agriculture | |
| Is water available throughout the year | after 15 min pumping water discharge [illegible] | |
| If not for how many months water is available | 7-8 months | |

| Pumping Duration | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
|---|---|---|---|
| Rabi (no of months to be specified) | 4 | 6 | .78 lps |

Bajri, Mirchi, Jawari, Toor Dal

# Annexure -III

## Farmer Feedback Form

| | | |
|---|---|---|
| | | Photograph |
| Name | Bheem rao Ram chougune | |
| Village | Revnal | |
| Block | Jat | |
| District | Sangli | |
| Address | [illegible] | |
| Mobile Number (optional) | | |
| **Type and number of structures** | | |
| Type | DW | |
| Number | 1 | |
| (coordinates of the structures are to be obtained by the field officer) | 17°7'14.5737.8 75°10'43.4850 | |
| Drill time discharge (lps) | 2'' | |
| Depth of installation of pump | 10mm | |
| Casing depth (Bore wells) HR | | |
| Fracture encountered depth-HR | 8mm | |
| Slotted pipe depths (TW) SR | — | |
| Average water levels – pre-monsoon | 43ft. | |
| Average water levels – post-monsoon | 20ft. | |
| The well is used for | Agriculture | |
| Is water available throughout the year | No | |
| If not for how many months water is available | 8 - 9 months | |

**Pumping Duration**

| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
|---|---|---|---|
| Rabi (no of months to be specified) | 3 | 4 | 2'' |

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | santosh badge | | |
| Village | Birnal | | |
| Block | Jat | | |
| District | Sangli | | |
| Address | | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | DW | | |
| Number | | | |
| (coordinates of the structures are to be obtained by the field officer) | 13°5' 43930 79°9' 1 657 | | |
| Drill time discharge (lps) | 2'' | | |
| Depth of installation of pump | 27 ft. | | |
| Casing depth (Bore wells) HR | 57 ft & 23 ft | | |
| Fracture encountered depth-HR | | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels – pre-monsoon | (BTT) | | |
| Average water levels – post-monsoon | | | |
| The well is used for | Drip Field | | |
| Is water available throughout the year | year | | |
| If not for how many months water is available | | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | 3 | 3 | 1.5'' |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 4 | 6 | 1.5" |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 3-4 | Bajri, Makka | |
| Kharif (no of months to be specified) | 4.5 | Jowari | |
| Others (no of months to be specified) | 2-3 | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | | | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | bajri, maka | | |
| Area under crop | 1 acre | | |
| Reasons for change in cropping pattern in last 20 years. | No loss | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | | | |
| Available Market for the crop | Jat | | |
| Average unit cost of production | | | |
| Average unit cost of selling | | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>Bajri - 2000, Makka - 2100, [illegible] - 2000, Jowari - 3000 | | |
| Other subsidies, facilities, restrictions. | PM Kisan Nidhi only | | |
| **Source of Energy** | | | |
| Solar | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | ○ Do you get free electricity for irrigation?<br>○ Do you pay a fixed charge Avg - 2000 Rs<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif—<br>○ During Rabi----- | | |
| Diesel | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

Photograph

| | | | |
|---|---|---|---|
| Name | Dhasarath ramu patil | | |
| Village | Achakanhalli | | |
| Block | Jat | | |
| District | Sangli | | |
| Address | | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | 2 | | |
| Number | 1BW & 1DW | | |
| (coordinates of the structures are to be obtained by the field officer) | | | |
| Drill time discharge (lps) | | | |
| Depth of installation of pump | | | |
| Casing depth (Bore wells) HR | | | |
| Fracture encountered depth-HR | | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels – pre-monsoon | 15 - 20m | | |
| Average water levels – post-monsoon | | | |
| The well is used for | Irrigation | | |
| Is water available throughout the year | yes | | |
| If not for how many months water is available | | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | | | |
| Khariff (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | | | |
| Area under crop | 9 acre | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Flood | | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | Less Rain | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | N.A | | |
| Available Market for the crop | Jath | | |
| Average unit cost of production | N.A | | |
| Average unit cost of selling | | | |
| Existing MSP and other related information | Crop wise details are to be collected | | |
| Other subsidies, facilities, restrictions. | | | |
| **Source of Energy** | | | |
| Solar | o Is it connected to grid No.<br>o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | o Do you get free electricity for irrigation?<br>o Do you pay a fixed charge ✓ 2000 per month<br>o If a fixed charge is paid, what is the per month charge<br>o If unit-based charges are paid what is the average monthly charges in rupees<br>o During kharif----<br>o During Rabi----- | | |
| Diesel | o Average consumption of diesel (liters) per month<br>o During Kharif No.<br>o During Rabi | | |

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गावाचे नाव/ village name [illegible] तालुका जत, जिल्हा सांगली

| Crops/पिके | | Area under Cultivation (in Ha)/ पिका खालील क्षेत्र |
|---|---|---|
| | Kharif / खरीप | |
| 1 | Jowar / ज्वार | ज्वारी 885 हेक्टर |
| 2 | Bajara / बाजरा | बाजरी 650 हेक्टर |
| 3 | Cotton/ कापूस | |
| 4 | Soyabean / सोयाबीन | |
| 5 | Groundnut / भुईमुग | भुईमुग 200 हेक्टर |
| 6 | Sunflower/ सूर्यफूल | |
| 7 | Pulses/ डाळी | |
| 8 | Maize/ मका | मका 350 हेक्टर |
| 9 | Potato/ बटाटा | |
| 10 | Turmeric/ हळदी | |
| 11 | Vegetables/ भाजीपाला | भाजीपाला 50 हेक्टर |
| 12 | Fodder/ चारा | चारा 45 हेक्टर |
| 13 | | |
| 14 | | |
| 15 | | |
| 16 | | |
| 17 | | |
| | Total | |
| | Rabi/ रब्बी | |
| 1 | Wheat / गहू | गहू 205 हेक्टर |
| 2 | Gram/ चना | |
| 3 | Safflower/ सूर्यफूल | |
| 5 | Jowar / ज्वार | ज्वारी 495 हेक्टर |
| 6 | Fodder/ चारा | चारा 50 हेक्टर |
| 7 | Maize / मका | मका 107 हेक्टर |
| 8 | Vegetables / भाजीपाला | भाजीपाला 20 हेक्टर |
| 9 | इतर | [illegible] 4 हेक्टर |
| 10 | | |
| | Total | |
| | Summer/ उन्हाळी | |
| 1 | Vegetables / भाजीपाला | |
| 2 | | |
| | Total | |
| | Perennial/ बारमाही | |
| 1 | Sugarcane / ऊस | ऊस 700 हेक्टर |
| 2 | Grape/ द्राक्ष | — |
| 3 | Banana/ केळी | — |
| 4 | Orange/ Sweet lime/ संत्रा मोसंबी | — |
| 5 | | |
| 6 | | |
| 9 | Other/ इतर | [illegible] 580 हेक्टर |
| | Total | |

Scanned with CamScanner

# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Gram Panchayat | | |
| Village | Mhaishwadi | | |
| Block | Jat | | |
| District | Sangli | | |
| Address | | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | BW | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.176177<br>75.380244 | | |
| Drill time discharge (lps) | | | |
| Depth of installation of pump | (150ft) | | |
| Casing depth (Bore wells) HR | | | |
| Fracture encountered depth-HR | 300 ft | | |
| Slotted pipe depths (TW) SR | — | | |
| Average water levels – pre-monsoon | 350 ft | | |
| Average water levels – post-monsoon | — | | |
| The well is used for | ~~[illegible]~~ Drinking | | |
| Is water available throughout the year | Yes | | |
| If not for how many months water is available | | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | 2-3 hrs | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | NA | | |
| Khariff (no of months to be specified) | —"— | | |
| Others (no of months to be specified) | —"— | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | NA | | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | | | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | NA | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | | | |
| Available Market for the crop | | | |
| Average unit cost of production | NA | | |
| Average unit cost of selling | | | |
| Existing MSP and other related information | Crop wise details are to be collected | | |
| Other subsidies, facilities, restrictions. | | | |
| **Source of Energy** | | | |
| Solar | o Is it connected to grid<br>o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | o Do you get free electricity for irrigation?<br>o Do you pay a fixed charge<br>o If a fixed charge is paid, what is the per month charge<br>o If unit-based charges are paid what is the average monthly charges in rupees<br>o During kharif— NA<br>o During Rabi----- [illegible] | | |
| Diesel | o Average consumption of diesel (liters) per month<br>o During Kharif<br>o During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Khandu Dhabale | | |
| Village | Valpeth | | |
| Block | Jath | | |
| District | Sangali | | |
| Address | | | |
| Mobile Number (optional) | | | |
| Type and number of structures | | | |
| Type | BW | | |
| Number | | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.108399<br>75.390135 | | |
| Drill time discharge (lps) | Total 500 ft | | |
| Depth of installation of pump | | | |
| Casing depth (Bore wells) HR | | | |
| Fracture encountered depth-HR | 350 ft | | |
| Slotted pipe depths (TW) SR | – | | |
| Average water levels – pre-monsoon | 250-300 ft | | |
| Average water levels – post-monsoon | 200 ft | | |
| The well is used for | Farming | | |
| Is water available throughout the year | Yes | | |
| If not for how many months water is available | – | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | – | 3-4 hrs | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 2 – 3 months | | |
| Others (no of months to be specified) | — | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 2 acre | | |
| Kharif (no of months to be specified) | 2 acre | | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Maka | Bajara | |
| Area under crup | 2 acre | 4 acre | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Maka | Bajra | |
| Area under crup | 2 acre | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | N/A | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>MSP(2022) Jawar-3180/- | Maka-2030/-<br>Bajra-2500/- | |
| Other subsidies, facilities, restrictions. | No | | |
| **Source of Energy** | | | |
| Solar | o Is it connected to grid<br>o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | o Do you get free electricity for irrigation?<br>o Do you pay a fixed charge<br>o If a fixed charge is paid, what is the per month charge<br>o If unit-based charges are paid what is the average monthly charges in rupees<br>o During kharif--- 3 - 4 hrs<br>o During Rabi----- 7 - 8 hrs | | |
| Diesel | o Average consumption of diesel (liters) per month<br>o During Kharif<br>o During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Madgyal Shrimant Laxman Kore | | |
| Village | Madgyal | | |
| Block | Jat | | |
| District | Sangali | | |
| Address | | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | BW – 4 (1) | | |
| Number | | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.138618<br>75.418521 | | |
| Drill time discharge (lps) | 500 LT | | |
| Depth of installation of pump | 550 ft (Total 750 ft) | | |
| Casing depth (Bore wells) HR | 110 ft | | |
| Fracture encountered depth-HR | 350 ft | | |
| Slotted pipe depths (TW) SR | NO | | |
| Average water levels – pre-monsoon | 550 ft | | |
| Average water levels – post-monsoon | -"- | | |
| The well is used for | Farming | | |
| Is water available throughout the year | NO | | |
| If not for how many months water is available | 8 months | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | 2-3 hrs | 2-3 hrs | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 10-12 Min | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | — | Maize, Jowar | |
| Khariff (no of months to be specified) | — | -"- — | |
| Others (no of months to be specified) | — | — | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Makka, Jowar Bajari | Jowar, Maka | Nil |
| Area under crop | 1/2 acre | Vallan | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | | | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | NA | | |
| Available Market for the crop | — | | |
| Average unit cost of production | | | |
| Average unit cost of selling | | | |
| Existing MSP and other related information | Crop wise details are to be collected | | |
| Other subsidies, facilities, restrictions. NO | MSP (2023) Jowar Rs 3180/- Maize Rs 2090/- Bajra – Rs 2500/- | | |
| **Source of Energy** | | | |
| Solar | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | ○ Do you get free electricity for irrigation?<br>○ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif—<br>○ During Rabi— | | |
| Diesel | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Namdeo Shidappa Birajdar | | |
| Village | Kolgiri | | |
| Block | Jat | | |
| District | Sangali | | |
| Address | | | |
| Mobile Number (optional) | | | |
| Type and number of structures | | | |
| Type | | | |
| Number | | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.104505 75.337827 Dugwell | | |
| Drill time discharge (lps) | – | | |
| Depth of installation of pump | – | | |
| Casing depth (Bore wells) HR | No | | |
| Fracture encountered depth-HR | 350-400 ft | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels – pre-monsoon | ~~[illegible]~~ 23-24 ft | | |
| Average water levels – post-monsoon | 26 ft | | |
| The well is used for | Farming | | |
| Is water available throughout the year | No | | |
| If not for how many months water is available | 5-6 Months | | |
| Pumping Duration | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) 3-4 months | | 3-4 hrs | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) 3 - 4 months | | | |
| Others (no of months to be specified) | NA | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 5 [illegible] | Bajra, Maize | |
| Khariff (no of months to be specified) | | Groundnut | |
| Others (no of months to be specified) | | Onion | |
| Cropping patterns (past and present) in the village | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | [illegible] | [illegible] | |
| Area under crop | [illegible] acre | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Maize | Bajra | Onion |
| Area under crop | [illegible] | [illegible] | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | NA | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>MSP (2012) [illegible] - Rs 3180/-; Bajra Rs 2850/- | | |
| Other subsidies, facilities, restrictions. | | | |
| **Source of Energy** | | | |
| Solar | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | ○ Do you get free electricity for irrigation?<br>○ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif—10-15 min<br>○ During Rabi—4-5 hrs (if water available) | | |
| Diesel | ○ Average consumption of diesel (liters) per month<br>○ During Kharif<br>○ During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

| | | | | Photograph |
|---|---|---|---|---|
| Name | Sanjay Mahadeo Changule | | | |
| Village | Karajangi | | | |
| Block | Jat | | | |
| District | Sangali | | | |
| Address | | | | |
| Mobile Number (optional) | | | | |
| Type and number of structures | | | | |
| Type | | | | |
| Number | | | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.102523<br>75.311127 | | | |
| Drill time discharge (lps) | 2 (600ft depth) | | | |
| Depth of installation of pump | 200 ft | | | |
| Casing depth (Bore wells) HR | 15 ft | | | |
| Fracture encountered depth-HR | 80 ft | | | |
| Slotted pipe depths (TW) SR | —no— | | | |
| Average water levels – pre-monsoon | below 200 ft | | | |
| Average water levels – post-monsoon | bl 100ft | | | |
| The well is used for | | | | |
| Is water available throughout the year | Yes | | | |
| If not for how many months water is available | — | | | |
| Pumping Duration | | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps | |
| Rabi (no of months to be specified) | 4 hrs daily | | | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 4-5 hrs | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 3 Acre | | |
| Khariff (no of months to be specified) | —4— | | |
| Others (no of months to be specified) | 1— | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Maka, | Jowari | |
| Area under crop | (Double) | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Maize | Jowar | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | NA | | |
| Available Market for the crop | — | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>MSP (2023) Jowar-Rs 3180/-, Bajra Rs 2500/-) | | |
| Other subsidies, facilities, restrictions. | No | | |
| **Source of Energy** | | | |
| Solar ✓<br>5L → 47,000/- | o Is it connected to grid<br>o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | o Do you get free electricity for irrigation?<br>o Do you pay a fixed charge<br>o If a fixed charge is paid, what is the per month charge<br>o If unit-based charges are paid what is the average monthly charges in rupees<br>o During kharif—<br>o During Rabi— | | |
| Diesel | o Average consumption of diesel (liters) per month<br>o During Kharif<br>o During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

| | | | |
|---|---|---|---|
| | | | Photograph |
| Name | Shankar Bhau Shinde | | |
| Village | [illegible] | | |
| Block | Jath | | |
| District | Sangli | | |
| Address | | | |
| Mobile Number (optional) | 9764472309 | | |
| **Type and number of structures** | | | |
| Type | BW | DW | |
| Number | 3 | 1 | |
| (coordinates of the structures are to be obtained by the field officer) | 16.979163 / 75.339575 | | |
| Drill time discharge (lps) | [illegible] 1" | | |
| Depth of installation of pump | 32 ft. | | |
| Casing depth (Bore wells) HR | 20 ft. | | |
| Fracture encountered depth-HR | 80 ft, 1½" 270 ½" = 1 | | |
| Slotted pipe depths (TW) SR | — | | |
| Average water levels – pre-monsoon | 53 ft. | | |
| Average water levels – post-monsoon | 165 ft. | | |
| The well is used for | Agri [illegible] | | |
| Is water available throughout the year | [illegible] 5-6 months Monsoon Season, [illegible] | | |
| If not for how many months water is available | 5-6 months | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | 3 [illegible] | 1 hr / 3 times/day | |

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pump works for 1 hr
and [illegible] 1 hr
[illegible] sump (farm pond) [illegible] 2500 lit.

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 3.5 [illegible] | 2 M. | 1 [illegible] |
| Others (no of months to be specified) | N.A | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 4-5 Bajri, Makka, [illegible] | Bajri, Makka, Tur | |
| Khariff (no of months to be specified) | 4-5 | Jowar, Makka | |
| Others (no of months to be specified) | 2-3 | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Bajri Maka Tur | Jowar, Makka | Matki |
| Area under crop | 2 A.M. | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Bajri Maka Tur | Jowar, Makka | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | Less Rain | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | Sugarcane tried, But not successful due to less water | | |
| Available Market for the crop | N.A | — | — |
| Average unit cost of production | N.A | — | — |
| Average unit cost of selling | N.A | — | — |
| Existing MSP and other related information | Crop wise details are to be collected<br>Bajri [illegible], Makka (Maize) [illegible] Tur [illegible], Jowar - [illegible] | | |
| Other subsidies, facilities, restrictions | [illegible], PM Kisan Nidhi | | |
| **Source of Energy** | | | |
| Solar | ▫ Is it connected to grid No<br>▫ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | ▫ Do you get free electricity for irrigation? Yes<br>▫ Do you pay a fixed charge No [illegible]<br>▫ If a fixed charge is paid, what is the per month charge<br>▫ If unit-based charges are paid what is the average monthly charges in rupees<br>▫ During kharif---<br>▫ During Rabi---- | | |
| Diesel | ▫ Average consumption of diesel (liters) per month N.A<br>▫ During Kharif<br>▫ During Rabi | | |

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# Annexure -III

## Farmer Feedback Form

| | | | Photograph |
|---|---|---|---|
| Name | Tukaram Vitthala Khot | | |
| Village | Lakdewadi | | |
| Block | Jat | | |
| District | Sangali | | |
| Address | | | |
| Mobile Number (optional) | | | |
| **Type and number of structures** | | | |
| Type | BW | | |
| Number | 1 | | |
| (coordinates of the structures are to be obtained by the field officer) | 17 188879<br>75. 421383 | | |
| Drill time discharge (lps) | (Total 300ft) | | |
| Depth of installation of pump | 200-250 ft | | |
| Casing depth (Bore wells) HR | | | |
| Fracture encountered depth-HR | 300 ft | | |
| Slotted pipe depths (TW) SR | | | |
| Average water levels – pre-monsoon | Dry (Tanker) | | |
| Average water levels – post-monsoon | 200 ft | | |
| The well is used for | Farming & Drinking | | |
| Is water available throughout the year | NO | | |
| If not for how many months water is available | 4-5 | | |
| **Pumping Duration** | | | |
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | | 3-4 | |

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| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | | | |
| Others (no of months to be specified) | | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | 1 acre | Bajra | |
| Khariff (no of months to be specified) | –"– | Jawar | |
| Others (no of months to be specified) | | | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jowar, | Bajra | |
| Area under crop | 1 acre | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Jawar | Bajra | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | no change | | |
| Available Market for the crop | – | | |
| Average unit cost of production | – | | |
| Average unit cost of selling | – | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>MSP (2023) Jawar – Rs 3000 – Bajra – Rs 2500 – | | |
| Other subsidies, facilities, restrictions | NO | | |
| **Source of Energy** | | | |
| Solar | ○ Is it connected to grid<br>○ If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric ✓ | ○ Do you get free electricity for irrigation?<br>○ Do you pay a fixed charge<br>○ If a fixed charge is paid, what is the per month charge<br>○ If unit-based charges are paid what is the average monthly charges in rupees<br>○ During kharif—<br>○ During Rabi— | | |
| Diesel | ○ Average consumption of diesel (liters) per month<br>○ During Kharif —"—<br>○ During Rabi — 4-5 ltr. | | |

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# Annexure -III

## Farmer Feedback Form

Photograph

| | | |
|---|---|---|
| Name | Vishwanath Shankar Patil | |
| Village | Nigadi (Kh) | |
| Block | Jat | |
| District | Sangali | |
| Address | Maruti Kirana Stores, Nigadi Kh. | |
| Mobile Number (optional) | | |
| **Type and number of structures** | | |
| Type | | |
| Number | | |
| (coordinates of the structures are to be obtained by the field officer) | 17.117882<br>75.270357 | |
| Drill time discharge (lps) | Bore well totally closed from last 4 months (Tanker supply) | |
| Depth of installation of pump | 980 ft (Total 850 ft) | |
| Casing depth (Bore wells) HR | 6 ft | |
| Fracture encountered depth-HR | 300 ft | |
| Slotted pipe depths (TW) SR | — | |
| Average water levels – pre-monsoon | below 300 ft | |
| Average water levels – post-monsoon | — | |
| The well is used for | Drinking | |
| Is water available throughout the year | No (8 months) | |
| If not for how many months water is available | 8 months | |

| **Pumping Duration** | | | |
|---|---|---|---|
| | Number of days pump is operated (days) of each well | What is the average pumping duration (in hours) of each well | Instantaneous Discharge Measurement (to be carried out by the field officer) in lps |
| Rabi (no of months to be specified) | — | — | — |

Electricity Problem

| | | | |
|---|---|---|---|
| Kharif (no of months to be specified) | 3-4 months | | |
| Others (no of months to be specified) | — | | |
| **Area Irrigated** | | | |
| | Area Irrigated | Type of crop taken | Remarks |
| Rabi (no of months to be specified) | — | Maize | Bajra |
| Kharif (no of months to be specified) | — | Jowar | |
| Others (no of months to be specified) | — | — | |
| **Cropping patterns (past and present) in the village** | | | |
| Traditional Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Bajara, Udit Maize | Jowar, Maize | |
| Area under crop | | | |
| Prevailing Cropping pattern in the village | Kharif | Rabi | Other |
| Type of Crop | Bajara | Jowar, Maize | |
| Area under crop | | | |
| Reasons for change in cropping pattern in last 20 years. | No change | | |
| If the cropping pattern is to be changed, which are the suitable crops that can be grown | NA | | |
| Available Market for the crop | NA | | |
| Average unit cost of production | — | | |
| Average unit cost of selling | — | | |
| Existing MSP and other related information | Crop wise details are to be collected<br>MSP(2024) Jowar- [illegible] Bajra - Rs 2[illegible] | | |
| Other subsidies, facilities, restrictions. | No | | |
| **Source of Energy** | | | |
| Solar | o Is it connected to grid<br>o If yes how much incentive do you get per month on an average for feeding electricity to the grid (Rs per month) | | |
| Electric | o Do you get free electricity for irrigation?<br>o Do you pay a fixed charge<br>o If a fixed charge is paid, what is the per month charge<br>o If unit-based charges are paid what is the average monthly charges in rupees<br>o During kharif—<br>o During Rabi— | | |
| Diesel | o Average consumption of diesel (liters) per month<br>o During Kharif<br>o During Rabi | | |

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## Minutes of the 12th meeting of the National Level Expert Committee (NLEC) 4th & 5th April 2024 at CGWB, CHQ, Faridabad

12th meeting of the National Level Expert Committee for review and finalization of aquifer maps and management plans was held on 4th and 5th April 2024 at CGWB Faridabad under the Chairmanship of the Chairman, CGWB. Findings of 19 representative studies were presented before the NLEC. Presentations were made by Regional Directors/HOO in respect of area covered in AAP 2023-24. Priority area wise numbers of presentations made in the meeting are summarized below.

***Region: CR, Nagpur Study:*** NAQUIM Studies in Inkatol block, Nagpur district, Maharashatra Comments of NLEC:

- The management plan is to be reviewed/ proper justification should be provided in respect of the proposed interventions.
- It was advised that management plans should be implementable.
- Comparison of rainfall with water level fluctuation may be incorporated.
- It was suggested that while giving any correlation plot/equation, $R^2$ value may be given
- Artificial recharge through already existing structures may be calculated. Also the efficacy of AR structures may be evaluated.
- It was suggested to use various parameters calculated from NAQUIM studies instead of normative values used for estimation.

## Refrences:


1) Agrawal, V., Vaish, A.K. and Vaish, P. (1997) Groundwater quality: Focus on fluoride and fluorosis in Rajasthan. Curr. Sci., v.73(9), pp.743-746.
2) APHA (1923) Standard Methods for the Examination of Water and Wastewater. 23rd Edition, American Public Health Association Inc., New York.
3) Apambire, W.B., Boyle, D.R. and Michel, F.A. (1997) Geochemistry, genesis, and health implications of fluoriferous groundwaters in the upper regions of Ghana. Environ. Geol., v.33(1), pp.13-24.
4) Bureau of Indian Standards (BIS)) (IS: 10500:1991, 2012
5) CGWB Systematic Hydrogeological Surveys report by D.K. Chadha (1975-76); N.G. Gajbhiye & D.K. Chadha (1976-77), N. G. Gajbhiye (1978-79); A R Bhaisare (1978-79); S K Jain (1987-88); P.K. Naik and B.K. Kallapur (1988-89)
6) District Ground water information booklet, Sangli district.
7) Deutsch, W.J. (1997). Groundwater Geochemistry: Fundamentals and Applications to Contamination Lewis Publishers, New York.
8) Godfrey S., Labhasetwar P., Chakma T., Wate S., Swami A.and Bartram J., (2011). Assessing and managing fluorosis risk in children and adults in rural Madhya Pradesh, India, Journal of Water, Sanitation and Hygiene for Development.136-143
9) Government of India. (2019). Canal and Drainage System. Ministry of Agriculture and Farmers Welfare. Retrieved from https://agricoop.nic.in/sites/default/files/Canal%20and%20Drainage%20System.pdf.
10) Karanth, K.R. (1987) Ground Water Assessment Development and Management. McGraw Hill Publishing Company Ltd., New Delhi.
11) Kumar, A., Raghuwanshi, N. S., & Singh, R. (2015). Canal network and water management for sustainable agriculture in India. Agricultural Water Management, 159, 29-42. doi: 10.1016/j.agwat.2015.05.005
12) Kruse, E. and Ainchil, J. (2003) Fluoride variations in groundwater of an area in Buenos Aires Province, Argentina. Environ. Geol., v.44, pp.86-89.
13) Madhnure, P., Sirsikar, D.Y., Tiwari, A.N., Ranjan, B. and Malpe, D.B. (2007) Occurrence of fluoride in the groundwaters of Pandharkawada area, Yavatmal district, Maharashtra, India. Curr. Sci., v.92(5), pp.675-679.

14) National Aquifer Mapping and Management Report of Sangli district, CGWB, CR, Nagpur, 2018.

15) Reconnaissance hydro-geological study of Sangli district.by J.P. Dias (1973).

16) Report of the Ground water resource estimation committee (GEC-2015), 2017 and 2023.

17) Rukah, Y.A. and Alsokhny, K. (2003) Geochemical assessment of groundwater contamination with special emphasis on fluoride concentration, North Jordan. Chemie der Erde, v.64, pp.171-181.

18) Shivaling B. Rajmane, 2019, A Study of Irrigation Setup in Sangli District. [VOLUME 6 I ISSUE 1 I JAN. – MARCH 2019] e ISSN 2348 –1269, Print ISSN 2349-5138, http://ijrar.com

19) Saxena, V.K. and Ahmed, S. (2001) Dissolution of fluoride in groundwater: a water-rock interaction study. Environ. Geol., v.40(9), pp.1084-1087.

20) V. M. Dikshit, (2020). Groundwater Recharge Potential Sites in Semi-Arid Region of Man River Basin, Maharashtra State, India: A Geoinformatic Approach. Nature Environment and Pollution Technology 19(4):1367-1378, December 202019(4):1367-1378, DOI:10.46488/NEPT. 2020.v19i04.003

21) US Salinity Laboratory Staff (1954) Diagnosis and Improvement of Saline and Alkali Soils. Agricultural Handbook No. 60, USDA, USA, 160.

22) Sahu, N.K. and Karim, M.A. (1989) Fluoride incidence in natural waters in Amreli district, Gujarat. Jour. Geol. Soc. India, v.33, pp.450-456.

23) Sangli District Statistical Handbook, 2022-23.

24) Wilcox LV (1948). The quality of water for agricultural use. US Dept Agriculture Technical Bulletin vol. 962, Washington DC.

25) Wilcox LV (1955). Classification and use of irrigation waters. U.S. Department of Agriculture Circular 969. Washington, DC: U.S. Department of Agriculture P 19.

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Ministry of Jal Shakti,
जल संसाधन, नदी विकास और गंगा संरक्षण विभाग,
Department of Water Resources,
River Development and
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**Central Ground Water Board**

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